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CIVIL ENGINEERING

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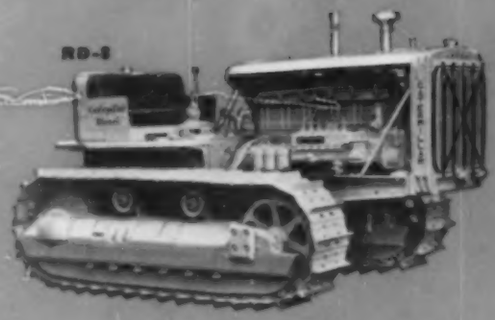
ERECTING 531-FT SIMPLE SPAN BY CANTILEVER METHOD, NEW ORLEANS BRIDGE OVER THE MISSISSIPPI
This Bridge, to Be Opened During the Month, Has an Overall Length of 4½ Miles, Including Approaches

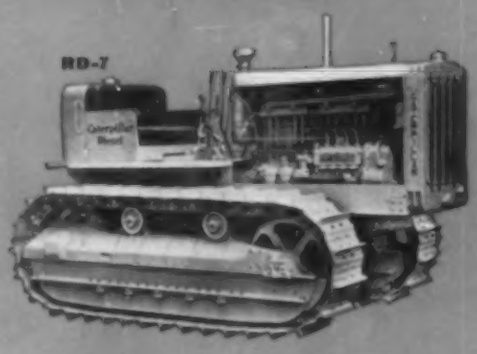
Volume 5 — Number 12

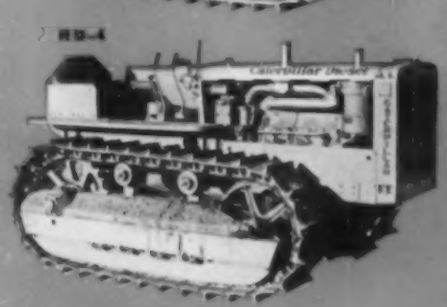
AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

DECEMBER 1935

FIRST IN POWER PERFORMANCE SAVINGS







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WHITE MARKERS GUARD CROSSINGS

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SIXTY-SEVEN per cent of all motor vehicle fatalities in 1934 in cities were pedestrians, according to the National Safety Council. And 42 per cent of these deaths occurred while the pedestrian was crossing a street *at an intersection.*

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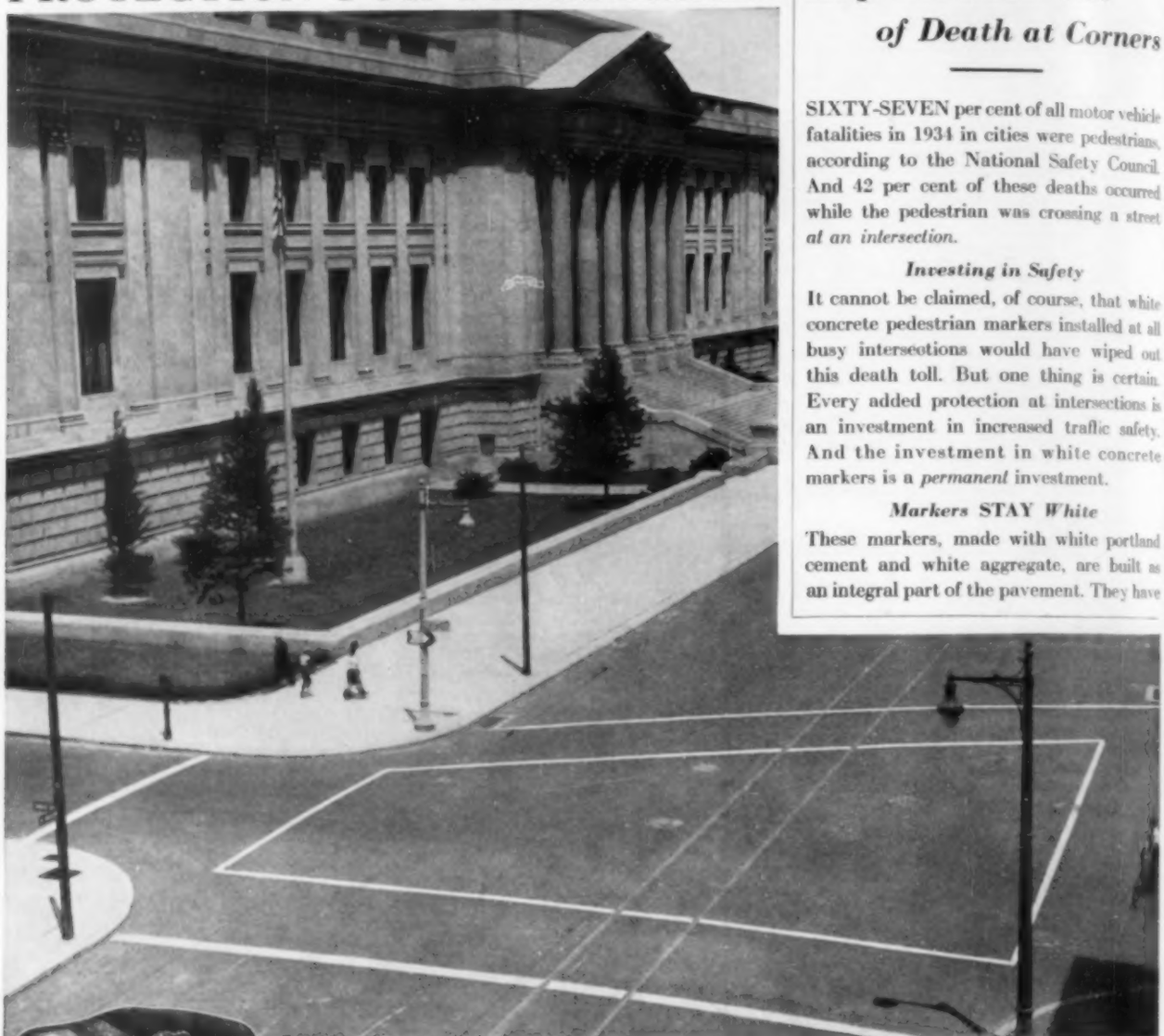

Atlas White concrete pedestrian lane markers guard this intersection on 20th Street in Philadelphia by the Benjamin Franklin Memorial. Installation by Eastern Asphalt Co., Philadelphia, under the direction of Dudley T. Cornung, Chief Engineer, Philadelphia.

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White concrete pedestrian markers can help to cut down intersection fatalities—they are a permanent investment in traffic safety.

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CIVIL ENGINEERING

DECEMBER 1935

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VOLUME 5 NUMBER 12

Construction Methods at Norris Dam

Compact Plant for Quarrying, Manufacturing Concrete, and Placing Proves Notable Success

By ROSS WHITE
MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS
GENERAL CONSTRUCTION SUPERINTENDENT, TENNESSEE VALLEY AUTHORITY, NORRIS, TENN.

"BUILDING a dam without a derrick" might epitomize this engrossing story of the work at Norris, Tenn., for the TVA. Instead of derricks, two cableways of 1,925-ft span and with 500 ft of lateral travel, covered the entire site, moving not only materials but even large equipment from section to section, using both cableways in tandem at times. Still another unusual feature of this work related by Mr. White is the convenient location and remarkable operation of an aggregate plant to manufacture both large and fine aggregate. What was only two years ago a ledge near the west abutment now forms the bulk of a million-yard dam. Much experimentation developed the fact that hammer mills could produce eminently satisfactory sand. A relatively dry mix, made possible by the use of surface and internal vibrators, was still another feature of this notable structure. This paper, supplemented by several reels of motion pictures, proved to be one of the outstanding presentations of the Birmingham Meeting, when delivered before the Construction and Highway Divisions on October 17, 1935.

ACROSS the Clinch River at a point about 25 miles northwest of Knoxville, Tenn., the Tennessee Valley Authority is constructing the Norris Dam. It is a straight gravity-type concrete masonry structure 253 ft high, 1,970 ft long, containing 1,000,000 cu yd of concrete. The construction schedule called for the start of work in October 1933 and substantial completion early in 1936. Final completion of the power house is dependent on deliveries of equipment by manufacturers, but is expected by July 1, 1936.

At the time work started, the only access to the site was over a narrow unimproved mountain trail, just barely passable for a car in dry weather. The nearest railroad point was at Coal Creek, five miles away; due to topography a railroad to the site would have been over eight miles in length with very severe grades and curvature and would have involved heavy excavation. As a highway to the site was necessary in any case, it was decided to build a road suitable for heavy-duty service, and to truck in all cement and miscellaneous freight. Both fine and coarse aggregates were to be produced at the site (Fig. 1).

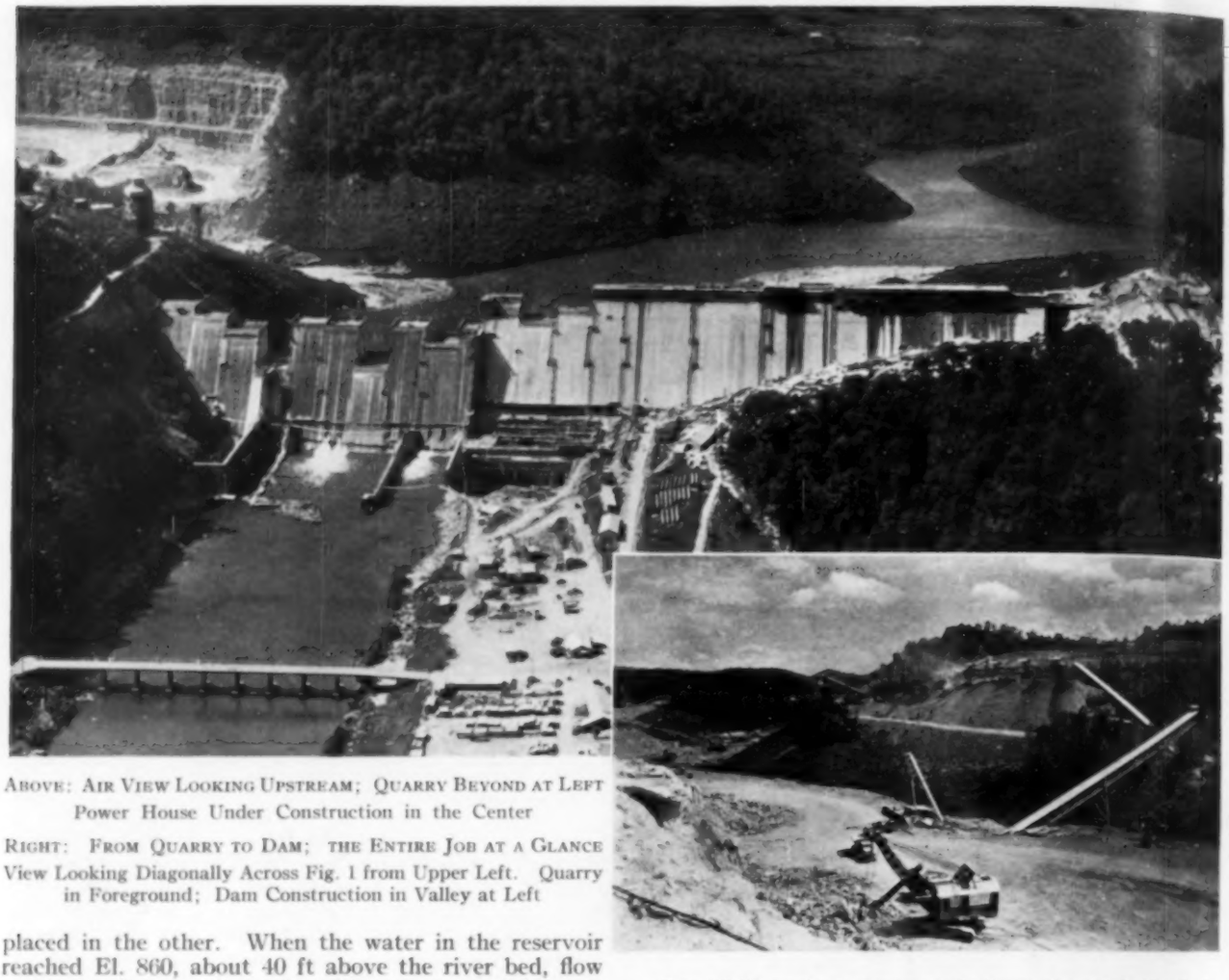
A contract was let for grading and paving a road leading from Coal Creek on the Southern Railroad five miles west of the work to the dam site. The concrete slab is 10–8–10 in. in thickness reinforced, and 22 ft wide. By a heavy concentration of standard road-building equipment, the contractor completed the grading and paving of this road in 69 working days. To eliminate settlement, all fills were brought up in thin layers and rolled. After nearly two years of service, only one 10-ft square slab of pavement shows any evidence of settlement.

Over this road to date has been hauled 1,000,000 bbl of cement, 8,000,000 fbm (feet board measure) of lumber, and thousands of tons of miscellaneous freight. Many heavy single pieces ranging up to 50 tons in weight have been loaded on a heavy-duty trailer and handled without difficulty. Two dump trucks of 8 cu yd capacity half loaded, furnish sufficient tractive and braking power for such a load.

RIVER DIVERSION IS ACCOMPLISHED

At the site the river channel is some 300 ft across, with no cover or overburden on the hard dolomite bedrock. Flow varies from a minimum of 400 cu ft per sec to a flood peak of 70,000 cu ft per sec with a vertical rise of about 40 ft. Large amounts of heavy drift are carried by all flood flows. Unlimited quantities of cheap timber were available from the reservoir basin and from other nearby areas.

Under these conditions, the decision was made to unwater half of the river, using a timber crib cofferdam. Within this cofferdam, the foundation would be prepared and concrete brought up to slightly above the natural river-bed elevation. The first cofferdam would then be removed and the other half of the channel would be cofferdammed, the river flow being carried over the concrete already in place. When the concrete in the second area was above the river level, all cofferdams would be removed and the flow carried through two blocks, purposely left low. Final closure would be made in the low-water season by using a large steel gate to bulkhead the two low openings alternately, forcing the whole flow through one opening while a 5-ft lift of concrete was



ABOVE: AIR VIEW LOOKING UPSTREAM; QUARRY BEYOND AT LEFT
Power House Under Construction in the Center

RIGHT: FROM QUARRY TO DAM; THE ENTIRE JOB AT A GLANCE
View Looking Diagonally Across Fig. 1 from Upper Left. Quarry in Foreground; Dam Construction in Valley at Left

placed in the other. When the water in the reservoir reached El. 860, about 40 ft above the river bed, flow would be diverted through eight permanent sluice-gate openings, thus completing river diversion operations. This schedule was carried through without trouble.

The most economical size of lumber available from the local timber was 8 in. by 8 in. by 14 ft, the saving in hauling costs and increased speed of fabrication more than offsetting the cost of sawing. The crib design therefore was based on this size of timber. Two parallel cribs, each 14 ft wide, were built 6 ft apart. For the first 16 ft up from bedrock, no tie members of any kind were permitted to cross this 6-ft gap. When filled with clay, it therefore acted as an unbroken seal or cut-off. Above the 16-ft elevation, several tiers of the 8 by 8-in. timbers were spliced across the opening, to tie the two cribs together. The outer or river crib was then carried 14 ft higher, resulting in a stepped-type crib over 30 ft high.

Both exposed faces were sheeted with a double layer of 1-in. rough lumber. A cell about 5 ft wide on the river side was filled with rock, for stability and protection against scour. All the rest of the crib, as well as the seal chamber, was filled with clay, taken from abutment excavation. The first cofferdam was over 700 ft in length and was gratifyingly tight, leakage being negligible at low or normal river heights and of only moderate proportions when flood flow produced an unbalanced head of over 30 ft. Sluice gates were opened, and the cofferdam flooded once, when a flood of 40,000 cu ft per sec threatened to overtop it, but it was unwatered easily when the flood crest passed.

One slight variation was made from the original schedule. During the low-water season of 1934, a small cofferdam of the "Ohio River box type" was run around part of the still untouched channel section, and this part of the foundation was prepared and concreted. This materially reduced the length and yardage needed in the final cofferdam, and resulted in a considerable saving in time and money.

Another rather unusual development was the use of concrete instead of timber cribs for the final cofferdam. The site was bare, clean rock and was under the cableways, thus making available the resources of the main concreting plant. As the river was at extreme low stage, a low rock and clay dike was quickly dumped outside the site of the main cofferdam, and the area was unwatered to a point where it was possible to place concrete retaining walls or dams instead of timber cribs. These dams were over 40 ft high. The concrete was mixed with three sacks of cement per cubic yard and produced an absolutely watertight and safe structure at a large saving over timber cribs.

The structural steel bulkhead gate used for final closure was 60 ft long and 11 ft high, and weighed 15 tons. It was handled from one block to the other by cableway. Less than three hours was required to move it from one block to the other, make a seal, and prepare for concreting. Timbers 12 by 12 in. in size were bolted to both ends and the bottom of the gate. In a groove about 2 in. deep cut into these timbers was placed a 3-in. fire hose, and over the hose a strip of light-weight rubber

belting. One edge of the belting was fastened solidly to the timber, while the other was free to move in a recess protected by a strip of strap iron. With no pressure on the hose, the belt presented a smooth surface, flush with the face of the timber. When pressure was put on the hose, it expanded and pushed the belt out about one inch from the plane of the face of the gate. This expansion was sufficient to overcome slight irregularities in the concrete, so that no special care was required in aligning forms. A leak the size of a lead pencil was as large as was usually found. Such leaks were readily sealed off by sifting a few coal cinders over the spot.

Foundation excavation will total over 500,000 cu yd. The bulk of this was handled by standard shovel and dump-truck methods. Spoil was wasted upstream from the dam, below the final reservoir level. The 3-yd all-electric shovels and 12-yd dump trucks, purchased primarily for work in the quarry, were used successfully in this foundation work, demonstrating the versatility of modern construction equipment. The left bank was on a slope flat enough to permit work in a series of benches. On the right bank, with a slope steeper than 45 deg, spoil rolled to river level, where the shovels could reach it. A light bulldozer, lifted into place by cableway, assisted in crowding the loosened material down the bank. In the river channel and east abutment, the final clean-up was by hand methods, loading directly into trucks. On the steep west abutment and other

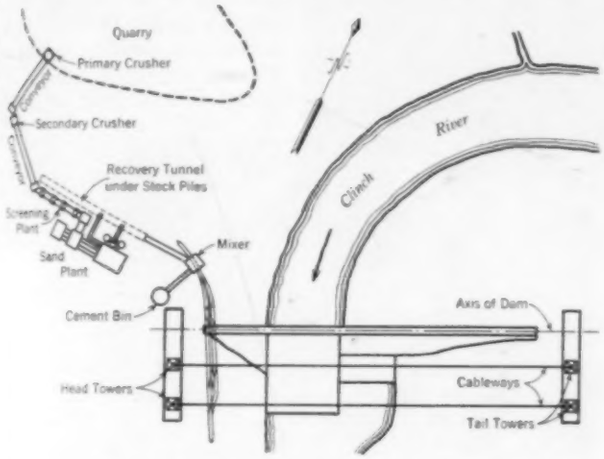


FIG. 1. SKETCH PLAN OF NORRIS DAM
Showing Compact Layout to Route Concrete Materials from the Quarry to the Dam with Minimum Handling or Delay

inaccessible points, 4-yd rock skips were spotted and removed by cableway.

In general, rock was removed to a depth of from 8 to 12 ft. To prevent the loosening or uplifting along bedding planes of rock immediately adjacent to the dam base, both upstream and downstream faces of the excavation were "line drilled." Wagon drills put down 3-in. holes on 4 to 6-in. centers, along the desired line. This weakened the rock enough so that, with careful blasting, no disturbance whatever occurred beyond the line.

The final preparation and grouting of the foundation developed into a major phase of the work. The foundation consists of a very excellent type of dolomite, in thick beds which lie nearly horizontal. At certain places, however, thin layers of clay were found between the strata of rock. To remove this clay, wagon-drill holes 40 ft in depth were drilled on 5-ft centers both ways. Air and water under pressure were introduced into alternate holes, and by means of a system of valves were forced through the seams in alternating directions. By means of expanding rubber seals, flow could be confined to any one seam. This washing was continued until the return flow from the holes was clear. All holes were then grouted, using a neat cement grout. A double-compartment power-driven grout mixer was developed on the job, to provide a constant supply of grout to the reciprocating-type grout pumps. This equipment had a capacity of 100 bags of cement per hour. Over 115,000 sacks of cement have been used to date in grouting the foundation.

After the grout had set, numerous 5-in. and 36-in. core drill holes were sunk, to test the efficacy of the work. In all cases, the clay was found to have been removed and the seams filled solidly with cement. The 36-in. core drill holes are large enough to permit lowering a man into them, so that the undisturbed walls can be inspected. Very much more information can be obtained in this way than by inspection of cores alone.

In addition to the grouting to the 40-ft depth just described, which covered the whole area of the foundation, a line of core drill holes 100 to 200 ft deep was drilled along the upstream face of the dam. These deep holes were grouted under high pressure after 100 ft or more of concrete was in place in the dam.

QUARRY OPERATION PROVES EFFICIENT

A favorable quarry site was located in a small side gulch about 1,000 ft upstream from the west abutment of the dam (Fig. 1). The area was a hillside on a slope of two horizontal to one vertical and was covered with from 2 to 15 ft of stiff red clay. A 12-in. spiral welded pipe line was run from the river and connected to a 3-in. nozzle monitor of the "hydraulic giant" type. Pumps were installed to supply 1,750 gal of water per minute at 150 to 200-lb nozzle pressure. On account of the tough character of the clay and the amount of small stones and gravel imbedded in it, this equipment proved to be just barely adequate. Most of the material removed was impounded in the gulley below the site, although some of the fines escaped to the river.

The site cleared was about 1,200 ft long and 400 ft wide. The depth of face at the outer edge was zero, and at the back, from 100 to 150 ft. The rock was hard dolomite, in nearly horizontal bedding. The primary crusher was placed nearly in the center of the quarry face, so that the average haul was not over 600 ft. Pneumatic tired trucks of 12-yd capacity were selected for haulage. Loading was done with all-electric shovels with 3-yd dippers. The dipper size was selected to fit the primary crusher, as a boulder that would just pass through the 3-yd dipper was approximately the largest size the 42-in. primary gyratory crusher would take without reblasting.

In working the quarry, the method varied considerably from conventional practice for a quarry of this type. The object sought was sufficient fragmentation to reduce secondary blasting to a minimum. To accomplish this, drilling was done with wagon drills, to a depth of 30 ft and spaced approximately on 6-ft centers. Block holing or secondary blasting was negligible in amount. Six wagon drills working 22 hr per day provided a supply of 6,000 tons of rock daily.

The quarry face was worked in benches 12 ft in width, each bench being carried to floor level before another was started above it. The rock broke to the horizontal bedding planes, so that a small amount of hand labor provided a smooth floor on which to work the drills for the next 30-ft cut. A caterpillar-type tractor, equipped with a bulldozer, cleaned up fly rock to economize shovel time and to provide a smooth floor for truck operation.

The last 250,000 cu yd of rock needed were obtained from below crusher level by lowering the quarry floor 60 ft in successive 30-ft lifts. The same general methods and hole spacing as before were used. The trucks handled their 12-yd loads up an 11 per cent grade without difficulty.

WORKMAN APPLYING COMPRESSED AIR TO OPEN BUCKET GATES

Primary crushing was done by a 42-in. gyratory crusher set to a 7-in. opening. All rock over 6 in. was scalped out and passed through a 5-ft cone-type secondary crusher. Belt conveyors (Fig. 1) carried the crushed rock to an elevated screening structure where vibrating screens separated it into five sizes. The four coarser sizes dropped directly into storage piles over a concrete reclaiming tunnel. Another belt conveyor carried all of the fifth size, consisting of sand and dust, and as much as needed of the other sizes, to a battery of four hammer mills, for fine grinding to sand. The hammer-mill product was screened into two sizes, which were stocked separately over the reclaiming tunnel and used in the proportion required. A surplus of material finer than 100 mesh is produced, which is removed in wet classifiers. This fine material is carried away by the wash water but is reclaimed by passage through a settling basin nearby, where it is available as a very high quality agricultural limestone.

Selection of hammer mills for the fine grinding was made only after rather thorough tests. Through the cooperation of manufacturers and of owners of various types of machines, a ton or more of sand was made in each of several types of machines, including rolls, ball mills, tube mills, cone-type crushers, and hammer mills. Rock for these tests was taken from the actual quarry and shipped to wherever a machine of the desired type was available. These various manufactured sands were then returned to the TVA laboratory and thoroughly tested and examined, in the form of mortar and concrete, with especial reference to workability and "bleeding" or water gain. As water gain is usually caused by a coarse or poorly graded sand, it is an excellent indication of the suitability of the sand.

The difference in the character of the sand produced from the same rock, but by different machines, was startling. Grain or particle shape was affected even more than grain size. Much of the success of concreting operations at Norris Dam is attributable to the happy solution of the sand problem. The engineering and construction staff wish to acknowledge the whole-hearted cooperation of owners and manufacturers, which alone made the tests feasible.

At Norris Dam the concrete production and placing plant continues the "straight-line" method started in the quarry (Fig. 1). A belt conveyor in the tunnel under the aggregate stock piles reclaims the various sizes as needed, delivering to steel bins over the mixers. After passing through weigh batchers to mixers, shuttle cars deliver the concrete to the cableways, which carry it to the forms.

In the mixing plant there are three 3-yd mixers, arranged concentrically, so that all discharge through the same funnel-shaped hopper. One set of weigh-batchers serves all three mixers. The standard-gage transfer cars are hauled by 8-ton gas-electric locomotives. Each car carries two 3-yd tilting skips, which discharge into the 6-yd cableway bucket. The haul from the mixers to the cableways is about 400 ft.

AGGREGATE AND CEMENT FROM BINS ABOVE ARE PROPORTIONED FOR NEXT BATCH

Dials in Front Give Weights. Mixers Are on Floor Below

The two cableways are each of 1,925-ft span and of 18-ton rated capacity, with movable head and tail-towers, operating on the same head-tower and tail-tower tracks. These tracks, of 42-ft gage, are about 500 ft long, so that the cableways cover all parts of the dam, power house, and spillway apron. This set-up (Fig. 1) is so flexible that not only concrete placement, but valve installation, erection of power-house steel, and all lifting of every sort are done by the cableways. No derricks of any kind have been required.

WELDING AND STRESS-RELIEVING WORK ON PENSTOCKS

40-Ton Sections Handled by Two Cableways in Tandem

Operators for the cableway are located in cabs high up on the head-tower, so that they have a clear view of most operations. Real control of cableway operation is by the signalmen, however, who are posted directly at the spot where work is being performed. Each signalman is connected by both telephone and bell circuits to the operators' cabs. Normal control is by phone, the bell being used only when the phone circuit fails. A loud speaker in the operators' cabs takes the place of the conventional ear-phone. The phone circuit is two-way, so that operator and signalman can converse as needed.

During the 8-month period of heavy concrete production, output averaged about 140 yd per hr, 23 hr per day, with a theoretical maximum capacity of the mixing plant of 180 yd per hr. For handling heavy loads, the two cableways can be operated in tandem. In placing the 20 ft diameter steel penstock sections, loads up to 40 tons were handled in this way.

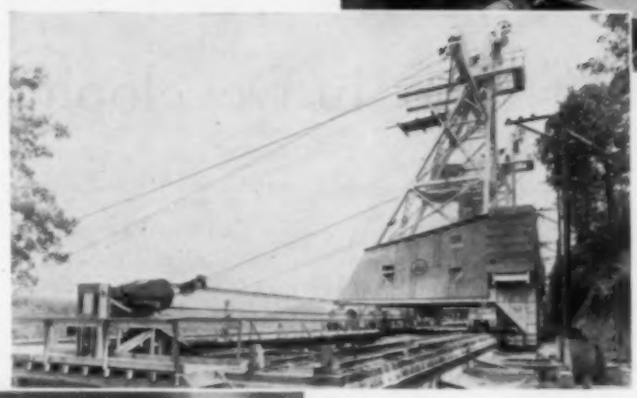
All concrete at Norris Dam was placed by means of mechanical vibrators of the internal type. For the rather harsh mass concrete of 1-in. slump, heavy two-man machines of about 3 hp were found most efficient. Tests showed that the efficiency of the vibrators increased rapidly with speed of vibration up to about 4,500 rpm. Above this point, increased speed did not seem to have much effect. In the case of electrical vibrators, the required speed of revolution was obtained by installing frequency changers, which stepped up the standard 60-cycle current to 80 cycles. This changed a normal 3,600-rpm motor into a 4,500-rpm unit. In spite of the fear of manufacturers, the vibrators operated at the higher speed without any particular difficulty. Using 6-yd batches, three of these machines will handle 90 cu yd per hr.

Forms for the mass concrete were in wood panels, of fairly conventional type, 5 ft high by 14 ft long, and were re-used 20 or more times. One variation from standard practice was in the method of handling the heavy panels. The cableway could not be spared for routine form raising, and the panels were rather heavy for hand work. Two small gasoline-powered self-propelled cranes, weighing about 7 tons each, were procured. The cableways could move these cranes to any block in the dam in about the time required to place one bucket of concrete. Once spotted in the block, the small crane lifted the panels at a small fraction of the cost of using heavy concrete-placing equipment for the purpose.

CLEARING QUARRY SITE OF OVERBURDEN
Hydraulic Monitor Operates at 200-Lb Pressure

All cement was delivered in bulk at the railroad siding in Coal Creek. Portable pneumatic-type unloaders pumped the cement directly from the box cars to a 6,000-bbl steel silo. Tank trucks, of 65-bbl capacity, after being loaded by gravity from this silo, hauled the cement 4 1/4 miles to the dam site. There the tanks were dumped into a pit, from which stationary pumps transferred the cement either directly to the mixer bins or to another 6,000-bbl silo. The pumps could also reclaim from the silo as needed.

As the work on Norris Dam was started during the period of greatest unemployment, it was considered desirable to use short work shifts to spread employment as much as possible. The scheme finally selected was a 22-hr day, made up of four 5 1/2-hr shifts, six days per week. This arrangement gave one hour free time at noon, and again at midnight, for servicing equipment. Where equipment servicing did not interfere too seriously, this was later changed to four 6-hr shifts daily.



CABLEWAY HEAD-TOWERS
Concrete-Block Counterweight at Right; Below It, Triangular Steel Frame with Horizontal Wheels Resists Cable Pull

WASHED SAND DELIVERED TO STOCK PILE OVER TUNNEL HOUSING CONVEYOR
Quarry Face Beyond

At first, gang foremen changed shifts every 5 1/2 or 6 hr, at the same time as the men. It soon developed, however, that it was almost impossible to secure efficiency or continuity of direction under this system, at least on a large project. The foremen were therefore put on an 8-hr shift basis, and their shifts so arranged that at no time did a gang and its foreman change shift at the same time. This scheme had the disadvantage that a gang worked part of a shift under one foreman and part under another, but it greatly improved efficiency. The foreman did not have to spend any time orienting himself and locating tools when a new gang came to work. Likewise, when a new foreman came on, the gang was already at work and the foreman could take whatever time was necessary to size up the situation without interfering with production. Under this system, reasonable efficiency was secured, but TVA experience indicates that short-hour, multiple-shift operation adds materially to the difficulty of supervision and direction.

The maximum number of men employed on the dam at any one time was slightly over 2,200, with an average of 1,800 for the past year. This number was divided among the four shifts, with the day shifts using about 50 per cent more men than the corresponding night shifts. Norris Dam now stands nearly complete. While in no sense entirely satisfied with the record made, those in responsible charge feel that if the job were to be started over again tomorrow, no major changes would be made in construction methods or equipment.

Development of the Southeast

Past and Present Trends in Manufacturing, Transportation, Power Production, and Agriculture

WHILE cotton may still be king in the South, there is today many a contender for his throne. Agriculture is steadily becoming more diversified; factories are each year more numerous. In the course of these changes, the need for scientific agricultural methods, industrial plant, transportation facilities, and power has created a wide demand for engineering skill.

In the first article of this group Dr. Bidgood reviews the transformation of the South that took place between 1877 and 1913, and calls attention to the important part played by the engineer in this transformation. Next Mr. Yates describes the present status of industry in the Southeast, and points to many factors that presage its continued steady growth. In the next article Mr. Hall states concisely the serious problems confronting the railroads of the Southeast and emphasizes the economic importance of a number of modern contributions to railroad engineering. Dr. Dyer pictures the devastation of man power following the Civil War, the wonderful recent recuperation, and the untold possibilities which he foresees provided government will permit the region to develop as it should. In the concluding article Dr. Morgan outlines the aims of the Tennessee Valley Authority and gives a strong defense of the social idealism it so well exemplifies. All of these articles are abstracts of papers or addresses delivered on October 16, 1935, at the Birmingham Meeting of the Society.

The Engineer's Place in Developing the South

By LEE BIDGOOD

DEAN, SCHOOL OF COMMERCE AND BUSINESS ADMINISTRATION, UNIVERSITY OF ALABAMA, TUSCALOOSA, ALA.

FOR the first time, as I believe, the Society has held a meeting in Alabama. This is significant of a rather wide and increasing appreciation of the importance of this section of the country. The southern states of the American Union, for the first two and a half centuries of American history, were a very important section of the country. After its catastrophic defeat in the War Between the States, and the still more disastrous decade of so-called "Reconstruction," the South ceased to be a particularly important part of the country, or at least to be recognized as such. The general conception of it was as an isolated backwater which had played its part in history and was no longer of any particular moment.

Since Woodrow Wilson's election to the presidency, there has been an increasing interest in the South, with appreciation of its progress and potentialities. Some people have been trying to explain this phenomenon, and I confess myself one of those who have been intrigued by it. I have come to the conclusion that the key to the situation is to be found in the generation which had charge of things in the South between the close of the Reconstruction period and the inauguration of the first southern-born president after the war. This is the "forgotten generation" between 1877, when Hayes called the federal troops away from the South and permitted the restoration of native white government, and 1913, when President Wilson was inaugurated.

JAPANESE PERSIMMONS GROWN IN EASTERN TENNESSEE
At the End of the Reconstruction Period, the South's Exportable Surplus Consisted Almost Entirely of Agricultural Products

As we contrast the contemporary scene in the southern states with the olden days, the work of the engineers in this period obtrudes itself upon our attention. In the design of this new South, the technical men have played a part inferior only, perhaps, to that of the doctors. The old-time South, the South of the seventeenth, eighteenth, and first two-thirds of the nineteenth centuries, had but little use for engineers or knowledge of engineering. Of course there were engineering works, but most of them were laid out as the Suez Canal is said to have been laid out by de Lesseps, who took his cane, drew a line in the sand, and said, "Dig here."

It is true that some of the earliest railroads were constructed in the South, that the *Savannah* was the first vessel to cross an ocean with even auxiliary steam power, and that Major Crozet of Napoleon's engineers enjoyed a long and distinguished career in the practice of his profession in Virginia. But these and similar cases are exceptions, or, at most, premature beginnings rather than typical occurrences.

In 1877 the southern states were relatively devoid of works of engineering and of engineers at a time when the progress of the region depended upon technical knowledge and its widening application. One of the first problems was that of transportation, both on land and sea. The South's exportable surplus,

upon which it was dependent, consisted almost entirely of agricultural products, shipped by water to Europe and to New England. Yet the end of the Reconstruction period found the harbors from Norfolk to Galveston almost closed to commerce by silt. Erosive action had been stimulated by from 100 to 250 years of extensive and unskilful cultivation. At the same time, vessels were of larger tonnage and their tonnage was obviously destined to be still further increased.

THE PROBLEM OF TRANSPORTATION

Inland transportation was in a condition almost equally unsatisfactory, with the river steamboat still the most important vehicle of transportation and communication. Its usefulness was limited by both flood and drouth; it was continually tormented by snags and sandbars and imperiled by rapids. While the steamboat served the plantations in the lowlands, it could not reach the hills where mineral wealth lay, or serve the future manufacturing areas of the Piedmont, or cross the mountains to provide "trunk-line" transportation. It was destined soon to go, together with the sailing ship, into the economic discard.

The war had ruined the railroads in the South, and during Reconstruction days they made little progress. The area embraced by the southern states is nearly a third of the whole country. Even today the population is relatively thin and widely dispersed, while in 1877 this condition was still more pronounced. Before any great economic development could occur in this region, the railways had to be improved greatly in roadbed, track, structures, and rolling stock, and extended greatly in mileage.

There had been some promising beginnings in highway building in the South as early as the last decade of the eighteenth century and the first decade of the nineteenth. I remember, as a boy, bicycling over excellent macadam roads in the valley of Virginia, which roads at that time were over one hundred years old. These roads were confined to the Virginia valley and the Kentucky blue grass sections, but even in those limited areas they underwent no notable extension as the nineteenth century wore on. In the lower South there had been a few plank roads, but they had rotted away. Thus, at the end of the Reconstruction period, southern roads were substantially all dirt tracks, washed and rutted, impassable during unfavorable weather, and limited to local traffic.

The same conditions which made river traffic so important were also a grave hindrance to the development of a railway net and of through highways. The South, especially the lower South, is a land of wide rivers and tidal estuaries. The Mississippi, draining half a continent, and, at that time unbridged below St. Louis, cuts the South in two. Hundreds of other rivers and arms of the sea blocked the development of land travel and transportation.

INDUSTRIAL DEVELOPMENTS UNDER WAY

Mountains interposed obstacles almost equally serious. The Appalachian system consists of thin and broken chains in the North, but in the South it broadens out to cover an area larger than all of New England, and rises into dozens of 6,000-ft peaks. Charleston, separated from Cincinnati and Chicago by 200 miles of mountain country as well as lesser obstacles, is a local port, whereas cities which do not have this mountain hinterland are national ports. By this plateau and mountain system, the south Atlantic ports are cut off from the Middle West, and the South itself is dissevered.

In 1877 the few small cities of this region were almost entirely without municipal improvements. Storm water drained off through deepening gullies; a few blocks of cobblestones hardly foreshadowed paving; the water supply generally came from wells, often polluted; and sanitary sewers were lacking. The coastal cities had no adequate wharves or docks, and some were without protection from storms.

Mechanical engineers and their works were as notably absent from the South of post-Reconstruction days as civil engineers, although both were needed. The ante-bellum manufacturers had small-scale businesses,

EXPORTING TOBACCO AT STATE DOCKS, MOBILE, ALA.
Tobacco Is Grown in Various Sections, But the Production of Cigars and Cigarettes Is Largely a Southern Industry

largely handicraft, which were adjuncts to agriculture rather than progenitors of industry. The cotton gin is sometimes referred to as the mechanical invention of greatest importance to the industry of the South, but in the larger view its effect is not wholly beneficial since it has fastened cotton culture upon the South and thereby forestalled any real industrial development. The field of machine production in the South in post-Reconstruction days was not only vacant, but was also barren, apparently.

The generation of electricity was a novelty in 1877—a scientific curiosity, with its future rôle in this region as yet unforeseen. Chemical fields too were utterly undeveloped, despite what Mallet and the elder Gorgas had extemporized for the Confederacy in its hour of extreme need.

The most important deficit revealed by this accounting is the scarcity and the lack of appreciation of engineers. It is true that some courses in engineering were offered in southern institutions. The University of Alabama taught a little engineering to all students in its early days, as did the Virginia Military Institute. The work was closely connected with military training, and it was not an accident that these two institutions furnished more officers to the Confederacy than did any other southern schools. For decades after the war nearly every engineer of note in the South was a colonel or a major, or at least a captain. But up to the end of the Reconstruction period, adequate curricula and facilities for engineering education were generally lacking, and student enrolments were too slender to supply the trained personnel necessary. The majority of the few engineers who were born in the South went to other parts of the world to practice their profession. For example, F. Hopkinson Smith, who is remembered more as

a painter and writer but who practiced engineering all his life, spent the greater part of his active existence in New York. His picture in *Six Hours in Squantico*, although unflattering and somewhat unfriendly, I still consider the best description of certain phases of the South during Reconstruction days.

GREAT PROGRESS MADE IN A SINGLE GENERATION

Such was the picture, from a technical viewpoint, of the prostrate South when the control of these states again passed into the hands of native white people. The outlook was unpromising indeed. Yet within a

SITE OF NORRIS DAM ON THE CLINCH RIVER
For Many Years Southern Rivers Formed the Most Important Means of Transportation and Communication

single generation, between the presidency of Hayes and the inauguration of Wilson, the native son, it was profoundly changed. The forgotten generation set in motion the physical transformation of the South, and, what is even more important, changed the attitude of this region toward engineers and engineering education.

The first notable engineering achievement of the new generation was the assurance of an open door to seaborne commerce. When Hayes was inaugurated, James Buchanan Eads was already at work at the mouths of the Mississippi, and by 1879 his system of jetties in one of the passes was complete. These jetties made possible the continued leadership of New Orleans in foreign commerce up until the opening of the Houston ship channel. As a result, the Crescent City still stands first in population among southern urban centers.

During the thirty years following Eads' great accomplishment, the federal government spent many millions of dollars in dredging harbor entrances and channels. The biennial rivers and harbors bills have been denounced frequently and vigorously as "pork-barrel" legislation. The denunciations have some basis in fact, yet I wonder whether the struggling smaller southern seaports would have been opened to deep-water commerce under any other system. In any case, but for the improvements made in dredging methods during those decades, appropriations would have been useless. The development of hydraulic dredging was particularly valuable to the South, where the harbor bottoms contain no rock (save coral in a limited Florida area), and are deepened far more easily and cheaply by pumping than by any other method.

The end of the troublous Reconstruction period was signalized by an outburst of activity in railway building. The decade of the 1880's, to be sure, was the greatest in the history of American railway building, with 70,000 miles of line constructed in those ten years. But the activity in the southern states was relatively far greater than that in the North, a fact that I think is generally forgotten, or, if remembered, is unappreciated. The country as a whole increased its railway mileage 75.4 per cent. The southern states, however, more than doubled their mileage, experiencing an increase of 103.8 per cent, while the North constructed about 70 per cent of additional lines.

The beginnings of a real highway system did not come until near the end of Reconstruction, and even in the closing decade of the nineteenth century, beginnings only had been made. Paved highways constitute the one major item of progress in the contemporary South which is not clearly attributable to the forgotten generation. The work of bridging the great rivers, which divide the South even more than they unite it, was begun in earnest in the 1890's. The opening of the Memphis bridge over the Mississippi in 1892 was the most notable event of that decade.

NEW HIGHWAY FROM COAL CREEK TO NORRIS DAM
Paved Roads Constitute the One Major Item of Progress in the Contemporary South Which Is Not Clearly Attributable to the Forgotten Generation

The contributions of engineers to the progress of the South during these times were in no respect greater than in the realm of municipal improvements. Here the connection between the work of the engineers and that of the doctors was very close.

EXAMPLES OF CIVIC PROGRESS

Memphis, the natural metropolis of the middle Mississippi, was perhaps the most promising city in the South in the years immediately following the War between the States. At that time Memphis was twice as large as Atlanta. But the yellow fever epidemics of 1878 and 1879 killed 5,000 of its residents and drove away thousands more. The population declined from 40,226 in 1870 to 33,592 in 1880; industry was paralyzed; and the city was unable to meet its current obligations. The remaining citizens devised a plan of commission government, under which Memphis was operated for 12 years. During this period the city was rehabilitated in all respects. The first step was the construction of water and sewerage systems. These were designed and built by George Edwin Waring, who there made his reputation as a sanitary engineer. For some decades, the Memphis water supply and sanitary sewerage systems continued to be looked on as outstanding examples of municipal engineering design and construction.

Gradually safe water supplies, storm and sanitary

sewerage systems, paved streets, and public parks were constructed in all the cities of this region. Nothing has been done since 1913 except to continue the process.

The first great sea wall, like the first great sanitary sewerage system, was the result of a calamity—the Galveston hurricane of 1900. Like Memphis and Mobile, Galveston resorted to commission government. By 1913, 7½ miles of sea wall had been built, and the whole site of the city had been elevated to its level. Subsequent hurricanes have been regrettable events but not major catastrophes.

During the years between 1877 and 1913, modern machine industry sprang up in the South, and in a few lines became highly developed. Cotton manufacturing underwent nearly all of its technical development in the North, and to a lesser extent the same is true of oil refining. But the tobacco manufacturing industry is purely southern. James Buchanan Duke bought and developed the cigarette-making machine which, after years of struggle, was finally worked out (by engineers) into a success. When machine manufacture finally entered quantity production, the Duke fortune was assured.

Hydro-electric power was a late development in the South, yet it was firmly established before 1913. Power dams were built throughout the Piedmont area from Virginia to Georgia. Most of them were small and some were poorly designed, but the way was prepared for the great developments of the last twenty years.

ENGINEERING COMES TO THE FORE

But the most important of all the engineering changes brought about by the forgotten generation had to do with the engineers themselves. The small engineering departments in the state universities were expanded into schools. Federal assistance was utilized to make the engineering divisions of the land-grant colleges in the South a reality rather than a hope. A few schools were founded for the development of engineering especially, such as the Georgia School of Technology and the Rice Institute in Texas.

During the 36 years between Hayes and Wilson, engineering work increased so greatly in the South and facilities for engineering education expanded so considerably that the profession became a major calling in this region. In 1877 the engineer was a rare bird, but by 1913 he had become a common species. Prior to the close of the Reconstruction period, engineering was seldom considered as a calling even by the few educated youths of these states. As early as the first decade of the twentieth century it was one of the possible careers considered seriously by the average high school graduate. This development has opened a door of opportunity to youth and has been a major factor in the material development of the South.

Looking back on the situation as a whole, I may say that the physical transformation of the South is to a very great extent the work of engineers, and that the change of attitude on the part of the people toward engineers and their services is fundamentally one of the most important reasons that account for the contemporary South. Without the engineers and their work, we should find it impossible to operate our rural schools on the consolidated plan; the work of our physicians would not be sufficient to protect the health of our people in cities; and transportation and communication would not have been carried to heights sufficient to make possible the social progress of the past two decades.

Past and Future Industrial Development of the Southeast

By E. A. YATES
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PREVIOUS to the Civil War, the South was almost wholly agricultural. After the War, however, it was forced to supplement its agricultural income by other means and gradually began the development of industry. It is now cognizant of its natural resources and manufacturing opportunities and the necessity for a better balance between agriculture and industry, and it is constantly working to improve conditions and attract outside capital.

The Southeast may be taken to include North and South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee. In 1914 the number of wage earners employed in industry in this area was 568,619 with annual wages of $219,319,000 and a value of manufactured products of $1,233,105,000. By 1929 the number of wage earners had increased to 842,290, the wages to approximately $659,198,000, and the value of manufactured products to $4,164,461,000—a 44 per cent increase in wage earners and a 200 per cent increase in annual wages in a 15-year period. Then came the depression. By 1933 the South had made an 80 per cent recovery of the number of wage earners employed in 1929 and the North a 60 per cent recovery; the recovery of 1929 wages was 58 per cent in the South as against 44 per cent in the North.

During the period 1910–1934, active cotton spindles in the Southeast increased from 10,334,000 to 17,442,000, or 70 per cent. Looms for weaving cloth have increased approximately 45 per cent. The consumption of cotton by the South in 1933 was in excess of 5,000,000 bales, or over six times the amount consumed in New England. Bank resources increased from $760,000,000 in 1910 to more than $1,800,000,000 in 1934. Public utility output increased from 3,000,000,000 kwhr in 1920 to 8,000,000,000 in 1934. The records of the industrial departments of the major power companies in six of these states disclose that in the five years just preceding 1934 approximately 500 miscellaneous manufacturing plants, employing a total of 28,000 men, were established.

Decentralization of industries is well under way throughout the North Atlantic and New England states. The result is benefiting the Southeast. More than ever the managers of eastern industries are thinking seriously of breaking up existing large plants, with the result that there is now an almost continuous stream of "prospects" coming into the Southeast and looking over various

locations with a view to establishing branch plants. It appears that taxes in the North are a great handicap. One northern manufacturer who constructed a large plant in Georgia stated that his taxes on this plant in the North would amount to $110,000 per year; in Georgia they totaled $12,000.

While the industrial trend of the South has been rapidly

THE STATE DOCKS AT MOBILE, ALA.
The Piers and Ship-Side Warehouses Are of Steel and Reinforced Concrete

upward, the production per capita is still considerably less than it is in the North and also considerably less than the average for the whole United States. The manufactured products listed for the Southeast and for the northern groups of states indicate that our southern industries are manufacturing principally coarser goods and semi-finished products.

INHERENT ADVANTAGES OF THE SOUTH

The moderate climate of the South enables a southern worker to maintain at less cost the same standard of living as the northern worker. This is an inherent advantage that the South holds and that can never be eliminated. I do not mean to infer that the southern laborer should enjoy any fewer of the necessities and luxuries of life than the northern laborer; I am simply pointing out that one can be just as happy in the South with lighter-weight clothing, less food, a less expensively constructed dwelling, and less fuel than in the North. Either the southern worker will receive less wages and be equally satisfied and happy or he will receive the same wages and have more luxuries than the northern laborer.

Electric power is adequate, reliable, and reasonably priced. High-tension transmission lines serve all communities, and the rates are competitive with any source of independent power. On practically all large plants coming into the South, it has developed that the rates of the southern power companies are on a parity with, or below rates in the area from which the industry came. That southern power rates are low is attested by the fact that practically all new industries coming into the South purchase their power from the utilities rather than provide their own independently.

The principal raw products of the Southeast are marble, granite, limestone, coal, iron, copper, zinc, gold, kaolin, fullers' earth, phosphate rock and natural gas; cotton, oats, wheat, potatoes, tobacco; farm animals and swine; pulp wood, lumber, poles, and cross ties. Bituminous coal, fuel oil, and natural gas are abundant. Excellent transportation by rail, highway, and air is available; markets in every direction can be reached by dependable and fast service by southern carriers. Freight rates are quite satisfactory.

The South is splendily supplied with water. The Appalachian Highlands, in the states of North Carolina, Tennessee, and Georgia, have an annual precipitation of 70 in., the highest of any state in the Union except Washington. The rivers and streams of this great watershed are rarely extremely low, and the quality of the water is excellent for boilers, bleaching and dyeing plants, rayon manufacture, and such. Where water for industrial use is purchased from municipal systems, the rates range from 6 to 10 cents per 1,000 gal.

AGRICULTURE WILL ALWAYS REMAIN BASIC

It is estimated that the purchasing power of over 75 per cent of the population of the Southeast is dependent directly upon agriculture. As local markets are becoming more and more a determining factor for new plants in the Southeast, the expansion of the purchasing power of this local market depends upon the increased prosperity from this basic industry.

The Southeast at the present time is a large importer of dairy products, eggs, pork, beef, corn, and hay, all of which can be economically produced within the area. A number of authorities have estimated that this territory imports, normally, an average of one billion dollars of foodstuffs annually. When our farmers produce enough to feed themselves, their livestock, and the industrial wage earners, more than one billion dollars annually of additional cash will be kept at home in the Southeast. This money will be available for the building of better homes and for the purchase of those luxuries that are only possible with a higher standard of living.

Already the extension service of the various states in the Southeast is showing the way, with its cover-crop

THE BUSINESS SECTION OF MACON, GA.

program. These cover crops not only protect the soil from erosion but increase the yield per acre of corn and other forage crops later planted on the same soil.

With a cheap source of supply of corn and legumes, cottonseed meal, and peanut meal, and with a long pasturing season and mild winters, the Southeast is destined to develop into one of the greatest livestock regions of America. The Southeast is considerably nearer such rich eastern markets as New York and Boston than are the Middle Western States, and its livestock and dairy products will find a growing market in this thickly populated area. We expect to see the packing industry established in a large way. Frozen

meats will be shipped to New York and Boston areas by all-water routes. The same is true of condensed milk and creamery products. Canning plants will be established to utilize surplus products of diversified agriculture, and, as industrial development grows, there will be more need for growing of various truck crops to be consumed by employees of local industries.

MANUFACTURE OF PAPER FROM SOUTHERN PINE

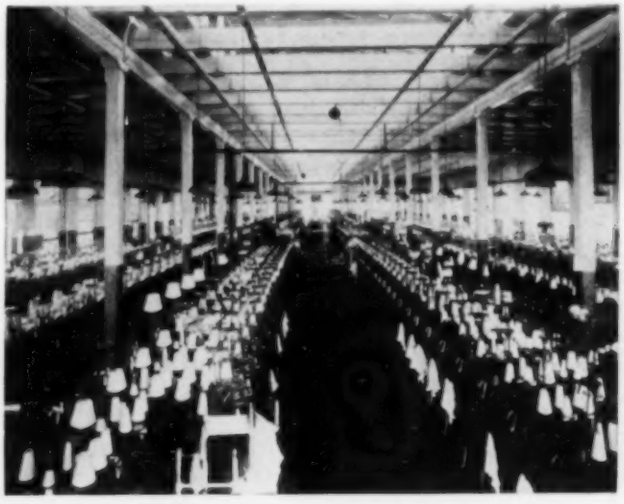
Hand in hand with this development of agriculture will go the development of forest lands, a great proportion of which are now owned by farmers. The expansion of the pulp and paper industry of the Southeast means a profitable outlet for cheap and abundant raw material, and new markets for coal, limestone, and other natural resources.

The most interesting work on the problem of grinding and pulping southern pine is that of Dr. Charles H. Herty, nationally known chemical engineer. The actual manufacture of newsprint on high-speed machines from pulp made in Dr. Herty's experimental plant at Savannah, Ga., has created widespread interest throughout the South. Recently a paper mill company in Mobile, Ala., has installed the first commercial groundwood plant in the South to utilize southern pine in the making of groundwood pulp. Already economical methods of bleaching sulfate pulp are being developed. This will open up an almost unlimited market for paper products manufactured from southern pine that will range from kraft container board through a variety of fine white papers to bleached pulp for rayon and a variety of cellulose products.

A MARBLE QUARRY NEAR KIZER, IN EASTERN TENNESSEE

A PAPER MILL AND BAG FACTORY AT TUSCALOOSA, ALA.
The Annual Output of This Plant Is 60,000 Tons of Wrapping and Bag Paper

With the paper industry will come chemical plants to make chlorine, caustic soda, sizing, filler material, pottery, and machine products. This development may easily surpass that of the textile industry. Practically all the necessary raw materials will be found near at hand—coal, lime, salt cake, resin, power, and sulfur.



THE KNITTING DEPARTMENT OF A HOSIERY MILL AT HARRIMAN, TENN.

OTHER PROMISING INDUSTRIES

We may expect a continued development of cotton manufacturing in the Southeast, along the lines of dyeing, bleaching, and finishing the many textile products that are now manufactured in this area "in the gray," and shipped to New England and other eastern states for conversion into the ultimate product. Already the movement of the so-called needle trades is under way, such as shirt plants and garment plants, converting southern products into finished articles.

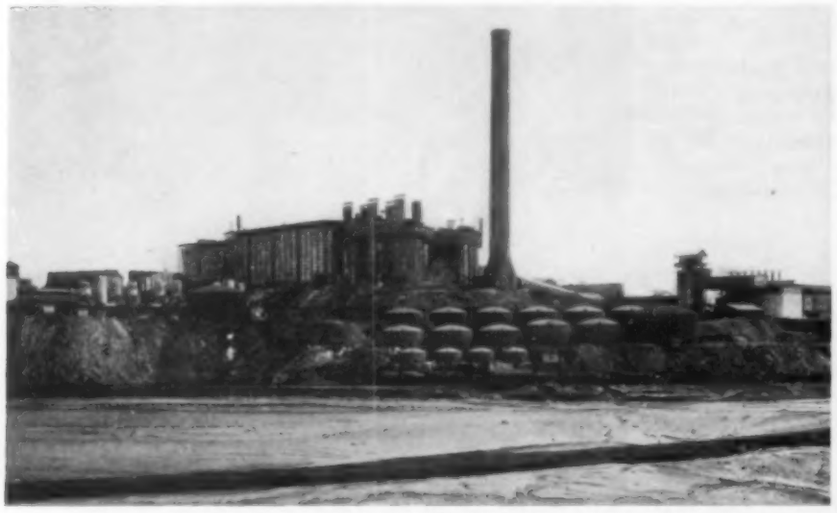
For the past several years, woolen mills and carpet mills have been looking to the South. Large quantities of southern cotton yarns are now being shipped to eastern plants to be converted into carpets, but there is no reason why mills sufficient to supply at least the local markets will not eventually be established in the Southeast.

With the development of the livestock and packing industries will come the tanning of leathers and the making of shoes. The U. S. Census of Retail Distribution shows that during 1929 the total value of shoes and other footwear sold in the southeastern states was approximately $140,000,000, while to supply this demand only approximately $20,000,000 of boots and shoes were produced locally. We can reasonably expect local plants to supply eventually a considerable proportion of the local demand.

The production of aluminum and its alloys is already important in North Carolina and Tennessee. It is felt that the future will bring further development as the trend to more economical and faster transportation makes necessary the use of lighter and stronger metals.

With high-grade kaolins and other clays, North Carolina, Georgia, Alabama, and other states confidently look forward to the local production of large amounts of pottery. These clays are now being mined and shipped from the Southeast as raw materials for industries established in northern states.

High Point, N.C., is today one of the South's major furniture manufacturing centers. However, there is still reason to believe that the woodworking industry has only started so far as the southeastern states are concerned. Raw materials are available in abundance, and as progress is made agriculturally and industrially the demand for furniture locally will materially increase.



SMELTER AND SULFURIC ACID PLANT AT COPPER HILL, TENN.
This Is Said to Be the Largest Sulfuric Acid Plant in the World

Northern Florida, southern Alabama, and southern Mississippi are now growing tung trees. Experiments and demonstrations indicate that tung oil, an important raw material in the manufacture of paints, can be produced along the Gulf coast at a cost to compete with the imported material now coming in principally from China. It is also the opinion of authorities that a local supply of high-grade tung oil will eventually replace a good proportion of linseed oil now imported from various countries.

For the past several years, Frederick J. Bates of the U. S. Bureau of Standards, Washington, D.C., has been working on the possibility of developing levulose sugar from the Jerusalem artichoke. Mr. Bates' investigations indicate that it is altogether possible to produce a high grade of levulose sugar from the artichoke tuber—a sugar that will compete with the cane sugar now imported from Cuba and the Philippine Islands.

At the present time the federal government is spending a considerable amount of money in an experimental plant at Laurel, Miss., working out an economical method of producing white starch from the sweet potato. Large quantities of this material are imported into the United States annually. If experiments are successful, this industry may develop on a large scale.

We expect to see expansion of our already existing iron and steel industry. The U. S. Tariff Commission's report, "Cost of Iron in Pigs," of 1931, shows that pig iron could be produced in Alabama considerably cheaper than in any other producing district in the United States. It is also possible that an even greater percentage of our pig iron will be fabricated locally into more finished products.

We have approached the period in the South's development where its businesses realize the folly of sole dependence on one major farm product and local capital for financing industry, and the necessity for an open-arm, fair-play attitude toward outside capital. The farmer has learned that the business man's conclusions are correct and that his own salvation is dependent on greater industrial development.

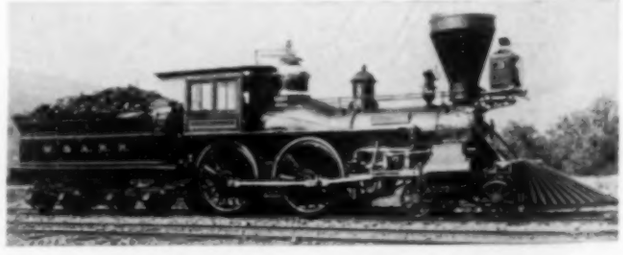
Present-Day Problems of Southern Railroads

By FITZGERALD HALL
PRESIDENT, THE NASHVILLE, CHATTANOOGA AND ST. LOUIS RAILWAY, NASHVILLE, TENN.

TRANSPORTATION in the southern states has had an interesting evolution. Within and surrounding them there are more miles of navigable waters than in all the rest of the United States together. As a natural result, water transportation was early developed, and there was excellent service of this character, generally without the benefit of canalization, when the railroads came into existence. Most southern railroads were orginally comparatively short lines designed primarily to connect strategic points on the waterways. I doubt if it was ever dreamed in those early days that the railroads would be more than a supplement to water transportation. The result, therefore, was that many roads were built quite differently from what they would have been if it had then been known that rail transportation would shortly take over most of the traffic handled by water. In later years, when those many small railroads connecting important river terminals combined into larger systems, the inevitable result was rather circuitous routes.

For a time after the development period of the larger railroad systems, the bulk of all transportation in this territory moved by rail. Then came the modern developments of highway and air transport and the intensive canalization of the rivers at government expense.

The railroads in southern territory have invested in road and equipment out of private funds something over



THE "GENERAL," OF CIVIL WAR FAME
Built in 1855, This Wood-Burning Locomotive Is Now on Exhibition at the Nashville, Chattanooga and St. Louis Station in Chattanooga

three billions of dollars. For the last four years the net deficit, after fixed charges, of Class I roads in the South has averaged more than $30,000,000 a year. Ten thousand miles of these roads are now in receivership; others are flirting with receivership. In the last three years these southern railroads have paid their stockholders in the aggregate an average of $2,500,000 a year, while at the same time paying the tax-gatherer an average of $30,000,000 a year. During this period the stockholders of southern roads have received an average of one-twelfth of one per cent per annum on their investment. Yet, in these depression years these same southern railroads have annually bought from industry about $85,000,000 worth of materials and supplies and paid their employees an average of about $200,000,000. Today their basic wage scales equal those of the peak of prosperity—an economic absurdity to say the least.

Changed conditions have brought about new problems for those who, representing the owners, run the American railroads. Not only have the railroads no longer any monopoly, but new forms of transportation can unquestionably perform certain services more expeditiously and better than the railroads. Whether in so doing, this service, after all charges are considered, is cheaper than railroad service is a matter of great doubt.

The railroads find themselves now meeting new and excellent forms of transportation service. This alone would justify no complaint on the part of the railroads, but on the contrary should act as a spur to improved railroad service. But the difficulty is that transportation by air, motor vehicle, and water is highly subsidized by government, and the cost of operation of every form of common carriage, except the railroads, is borne in large part by the taxpayers. The federal government is operating large lines on some of our southern rivers at a loss, made good by the taxpayers, thus taking the business away from the railroads, which pay all their own costs. In addition, no form of public carriage has been subject to regulation comparable to that to which the railroads have long been subject. The last congress made a good beginning in relation to motor vehicles, but it was only a beginning.

As a result of these conditions, plus the many burdens, some wholly without economic justification, imposed upon the railroad industry by the federal government and the labor unions, the railroad industry as a whole finds itself today unable to operate at a profit. This unfortunate situation is in large measure attributable to the lack of any intelligent and sane transportation policy in this country and to political ineptitude in dealing with the general railroad problem.

Artificial devices, largely the result of politics, have in recent years interfered with the natural working of the law of supply and demand and have enormously increased the cost of railroad operation—that is, the price paid for labor, the price paid for both raw and fabricated materials, and taxes.

TECHNICAL ACHIEVEMENTS HAVE REDUCED OPERATING AND MAINTENANCE COSTS

If it had not been for certain remarkable technical achievements it is doubtful if any railroad could now operate profitably at all. The creosoting of cross-ties alone has resulted in an annual saving to the American railroads of not less than $55,000,000 a year. Some experts place this figure as high as $120,000,000 a year.

Improvement in both the weight and character of rail and track appliances and the use of modern machines, such as steam shovels, roadway cranes, ditchers, tie tampers, and weed destroyers, have enabled the railroads in the last fifteen years to reduce their expenditures for the maintenance of road and structures approximately 50 per cent. In 1922 the railroads spent for this purpose $736,181,000; last year they spent only $365,285,000. In spite of this tremendous reduction, due to technical advancements, main-line tracks generally are able to handle, with perfect safety, faster and heavier traffic than heretofore.

Intensive study of water problems, with improvement in water supply equipment, and the treatment of water, has resulted in an annual saving to the railroads as a whole in the last decade and a half of about $50,000,000.

THE 80-YEAR-OLD "GENERAL" AND HIS STALWART SUCCESSOR
The Dixie-Type Locomotive, Built in 1930, Is Adaptable to Either High-Speed Freight or Passenger Service

There are a great many people who say that the railroads have been standing still while their competitors have made striking advancements in the art of transportation. Nothing could be further from the truth. Let us consider first the improvement in the operation of steam locomotives in the handling of freight. The total volume of freight traffic handled by the railroads in the United States in 1934 was approximately the same as it was in 1922. Yet this traffic in 1934 was handled with 25 per cent fewer trains, which consumed only about 66 per cent as much fuel and ran on schedules that averaged less by $2^1/_2$ hr for each 100 miles. A modern steam locomotive, compared with the very best of twenty years ago, will operate on the average at an increased speed of 33 per cent, with a drawbar pull of 33 per cent more, and with a consumption of fuel of 33 per cent less.

Between 1922 and 1933 the speed of freight trains for all Class I roads in the country increased 41.5 per cent. One of our great western railroads with a modern 2-10-4 type freight locomotive, as compared with a 2-10-2 type built in 1920, has increased its train load capacity 45 per cent, its speed 33 per cent, and has reduced its fuel consumed per 1,000 gross ton-miles 41 per cent—and all this was done without any appreciable increase in axle load.

The average tractive power of a modern locomotive as compared with one built before 1915 shows an increase of 100 per cent. While this increased tractive power is substantially constant at any speed, the drawbar pull necessarily varies with grade, curvature, and condition of the rails. So the effective horsepower of a modern steam locomotive as compared with one built in 1900 has increased over 400 per cent, while the increase in horsepower per driving axle has increased 132 per cent.

While public imagination has been caught by some of our remarkable new passenger trains, yet as a matter

of fact their speeds do not exceed what was possible and what was actually done some 20 years ago.

The railroad industry is peculiar in several respects. One is that practically everybody thinks he knows how to run a railroad, particularly if he has never run one, and more particularly if he has never run any business successfully. It is suggested, for example, that one way for the railroads to regain their lost business and their financial stability is to run very fast, streamlined passenger trains equipped with every modern creature comfort, and to reduce the size and weight of freight equipment and increase the speed of freight trains. Let us study these suggestions from the standpoint of those in managerial positions—presumably competent experts.

THE DIXIE FLYER, JUST OUT OF CHATTANOOGA IN THE LOOKOUT MOUNTAIN COUNTRY
A Chicago-Florida Train of the Nashville, Chattanooga and St. Louis Railway

As to possible saving in track costs, the initial cost, as well as the cost of maintenance, of preparing a track for trains depends not only on the weight and speed of the trains, but on the character of the road, the topography traversed, and the character of the traffic. For example, if a given track is maintained for freight service alone, with trains running 50 miles per hour, the cost is estimated to be about 60 per cent of what it would be if fast passenger trains also used the same track. It is generally estimated that, as far as initial construction costs are concerned, the character of track and structures for passenger trains operated at about 70 miles an hour is approximately the same as for freight trains operated at 50 miles an hour. Also it is generally known that the cost of maintaining track used by freight trains alone is considerably less than for track over which run either nothing but passenger trains or both passenger and freight trains.

The result is that there can be no generalization which is at all adequate. Take a road such as the Nashville, Chattanooga, and St. Louis Railway, largely single track. On this track run local and high-speed freight trains—also local and high-speed passenger trains. The territory served is largely rolling and much of it mountainous; the curves and grades are numerous and severe. The resulting effect on speed, weight of train, and wear and tear of rail, is very different from that which obtains on a line on the plains of the West or the Atlantic seaboard, which is substantially level and straight. Our present maximum allowable speed for passenger trains is 60 miles an hour; for freight trains, 40 miles an hour. To prepare that same track for an increased speed in all classes of trains of 20 per cent would involve a preliminary expenditure of not less than $1,600 per mile, with an increased annual maintenance of roadway alone of about $225 per mile. If higher speeds are desired, much of the road would have to be realigned and there would have to be substantial grade revision. Not only would the cost of this be prohibitive, but probably many communities now served would be eliminated.

LIGHTER EQUIPMENT MAY NOT REDUCE OPERATING COSTS

It is suggested by some that, if we reduce the weight of our units of equipment, the initial cost of track construction and the annual cost of maintenance would be greatly reduced. This of course presupposes that we would do away with practically all existing heavy power and equipment. Economically, this is impossible. In addition to that, expenses for maintenance of way and of structures is affected by train use only about 33 per cent. The remainder of the expense is the result of time and the elements. If lighter units of equipment are used, permitting heavier loading with a total load of approximately the same as at present, there would be no economy so far as roadway construction and maintenance are concerned. If all existing equipment were scrapped and smaller and lighter units put in its place, with smaller and lighter loads, then there would have to be many more trains, so that, by reason of increased use, any saving of the track structure, with consequent reduction of expense, would be more or less negligible. If, in addition to running more and lighter trains, the speeds should be materially increased, it is questionable whether there would be any saving at all. If our labor expense, which is our largest single item, remains the same for a small train of light cars as for a large train of heavy cars, the running of more trains would materially increase our transportation expense. So the question arises whether resorting to this suggested modernization would not in the end, outside of capital charges, increase rather than reduce total operating expenses.

The question arises as to whether a railroad manager, in the face of all these things, should undertake to materially increase train speeds. Eliminating for the moment competition with other forms of transportation and as between railroads, what is the economic value of increasing the speed of passenger trains 20 per cent or more? I am not talking about mere convenience to an individual, or about exceptional cases, but of the ordinary situation of a person going from one place to another. What difference would it make to the average man to be able to go from Nashville to Atlanta in 6 hours instead of 8, or from Nashville to New York in 20 hours instead of 24? I am not at the moment discussing the necessities due to competition, but the real economic worth of faster service. I think it doubtful, to say the least, whether, considering the average individual who travels, the economic value of increased speed is worth the cost of furnishing that speed.

Let us consider the matter of streamlining. That this has an advertising value, that it has an appeal to the imagination of the people, is certainly true. But what is its real economic value? Let us take automobiles for example. No less an authority than Alfred P. Sloan states that, so far as the average automobile is concerned, the fuel saving by reason of streamlining is absolutely inconsequential and, speaking generally, ". . .the contribution of streamlining is definitely limited to the question of styling." Now in the field of railroading what is the real economic value of streamlining? It is generally agreed that streamlining to minimize air re-

sistance does not become effective until a speed of 60 miles per hour is attained. Therefore, reduction in the actual operating costs of moving a train from place to place by reason of streamlining would seem to be largely negligible. At least I have been able to find no accurate data to the contrary.

RAILROADS MUST GIVE PUBLIC WHAT IT WANTS

I realize of course that in selling transportation, railroads, within certain limits, must do what those who sell anything must do—namely, give the public what it wants. Railroad managers cannot sit down and pass judgment on the wisdom of the people in what they want. They cannot content themselves with giving service with the greatest economic value.

Generally speaking, increased speeds of freight trains do have a definite and more or less tangible economic value. Goods on a freight train are earning their owners no money. It is like capital tied up, yielding no return. In recent years there has been a decided change in the method of handling most businesses, particularly retail. Merchants no longer buy large stocks two or three times a year. They have found that it saves them money to keep on hand a small inventory, adding to it from week to week as it is disposed of. The result of this modern method of doing business makes the fast handling of freight generally of real economic value.

But after those in charge of a railroad prepare their track and rolling stock for high speeds, with increased tractive power, they frequently find themselves unable, under normal economic conditions, to utilize to the fullest extent either the maximum speed or the maximum tractive power. People want to get to certain places at given hours, so trains must be run, not to get the maximum out of the traveling facilities, but to please the traveling public. The result is that, particularly under depressed business conditions, few trains in our territory are ever filled to capacity.

All these matters present tremendous difficulties, of course, to those in charge of the railroads. When we make vast expenditures to please the public today we may find it wanting something quite different a little later on. It was only recently that the public was demanding the heaviest steel passenger equipment—now it is demanding something new and different. A railroad is a vast and expensive machine. It is built for mass transportation. Given large numbers of passengers and large quantities of freight, it is the cheapest transportation method in the world, except ocean travel. But railroad expenses cannot be currently reduced in proportion to varying traffic. Many of our expenses are more or less stable. The result is that with heavy traffic a railroad is a very profitable industry; with light traffic it is not.

A Brilliant Future for the South

By GUSTAVUS W. DYER

PROFESSOR OF ECONOMICS, VANDERBILT UNIVERSITY, NASHVILLE, TENN.

I HAVE a very wide field, almost as wide as that of a hard-shell Baptist preacher who announced the divisions of his sermon thus: First, he said, he would discuss man before the fall; second, man after the fall; and third, baptism. So, I suppose I am expected to discuss the South before the fall, the South after the fall, and then wind up with some observations on modern trends.

In facing the development of a great section, it is of the greatest importance that you should know its past. Now it is universally claimed by the historians that the South on account of slavery stood still while the rest of the country moved forward, and that the South in 1860 had made very little material progress. That view has no foundation whatever; the South had made great progress, as great as the rest of the country before the Civil War, and no part of the country was in a better economic condition, and was so rich as the southern states in 1860.

RAILROADS PLAY A BIG PART

Whatever might have been accomplished through the application of steam to machinery, we could not have had this modern industrial world without the railroads. And the first was built in 1827 by South Carolina. Of course it was slow, for a while. It was costly; it was experimental.

At no time in our history, anywhere, has there been greater railroad activity and railroad construction than took place in these southern states between 1850 and 1860. They built 6,243 miles of railroad in ten years; and between 1850 and 1860, the eight southeastern states built 6,243 miles of railroad at a cost of $172,000,000. In 1850 these states had spent $40,000,000 for railroads, and in 1860 they had spent $212,000,000. In 1850 there were but four states in the Union outside of the South that had as many miles of railroad as Virginia. And Georgia had more mileage than Virginia.

The increase in railroad construction was greater in the slave states than in the rest of the country. The increase in the southern states from 1850 to 1860 was 350 per cent; in New England it was 46 per cent; and in the rest of the country it was 332 per cent—which shows that the case of the South is not a case of beginning industrially after the war; it is a case of arrested development. The South was getting into this industrial game with tremendous force before the war, notwithstanding the theory of the historians.

As a measure of economic progress, banking is a pretty good test of the general condition of a country. The amount of capital per capita free population invested in banking was as follows: In 1860, the southern states had $15.40 and the remaining states of the Union had $10.80. The amount of loans per capita in the southern states was $25.00 and in the remaining states $18.70. The amount of deposits per capita in the southern states was $7.90, and in the remaining states $5.50. So these southeastern states in 1860 were making great strides in industrial progress, in building railroads and factories, and in going forward in the banking business.

AFTER THE WAR—A PATHETIC PICTURE

Now the war arrested all this development; destroyed it. The South, in the first place, sent every man capable of fighting to the front. The great body of them never came back. The greatest economic loss to the South from the Civil War was not the money, the property—it was the loss of the workers, the men. That is the

greatest loss any country can sustain. We make a mistake in measuring economic strength by wealth accumulated. That is not very important, relatively. The economic strength of a country is in the productive power and efficiency of its workers, and when you destroy them it takes a long time to recover. And in 1865 it was only a remnant of the Confederate Army that came home. They were largely wounded, sick, and crippled. And

AERIAL VIEW OF ATLANTA, GA.
An Important Business and Industrial Center of the New South

they found everything had been destroyed that could be destroyed. Their farms were in desolation—no money, no capital, no credit. There is hardly a more pathetic picture anywhere in human history. They were compelled to go back to almost primitive conditions and begin all over again.

As a boy I admired a man in our community because he had lots of money, and everything in the world that a fellow would want. He had a great big red threshing machine, too, that he used to carry around. Something happened, he failed; everything was sold at auction and he was left completely stranded. But he did not give up. He broke two calves to work, and I can see him now, driving these calves hitched to a small cart, on his way to make a crop. This is a picture of the Southerners coming back after the war—except that they did not have the bull calves.

I have told you the dark side. There is one bright side to it, and that is, the government did not come in to help them. They came back and went to work under the Constitution—no pensions, no Security Act, no government direction. The people of this country always come back when the government gives them a chance to exercise their freedom under the Constitution. Now that went on and they gradually kept coming back, chiefly because the South had men who were capable of taking advantage of the natural resources it had in the raw.

STEAM—A CENTRALIZING POWER

Then the next factor in the development of this Southeast was the new industrial revolution. We never had had but one industrial revolution before, and that was the steam revolution. When steam was applied to machinery and transportation, it brought brains into business. The development of the natural sciences had much to do with bringing brainy men to study this field, because the application of chemistry and physics through engineering was in the business field, and with this we progressed by leaps and bounds in industrial development. This modern world is the product chiefly of that steam revolution in railroads, and the application of steam to machinery. We could not exist today without it. In large cities, people would starve to death in great numbers under old transportation facilities.

The whole trend of the steam revolution was to centralize industry. This is what built up our great cities. That is, there was an economic advantage in centralization. It put the rural sections out of commission so far as manufacturing was concerned. The economic advantage of the big center was too great for them to meet. It made it extremely difficult for the small places in the Southwest and these southeastern states to compete at all satisfactorily with the great factories in the great centers.

This new revolution, which I think we have not interpreted at all yet—I call it the electric-gasoline revolution—is changing the whole order of society. It is a very revolutionary force, and we are trying unwisely in many cases to fight it. But there is no use; it can be delayed, but it cannot be prevented. Electricity had been known a long time, but was never considered a revolutionary force. It brought certain luxuries but these were not revolutionary.

THE RURAL COMMUNITY COMES BACK

Now, what has this revolution done as affecting the Southeast in its development? Just as the steam revolution was centralizing, this new revolution is fundamentally and radically decentralizing. It is driving business out. It has to go, a great body of it, to new territory. There is no guessing about it. When the steam revolution came, the railroads (responding as always to the demands of the people) were used as factors in centralization. This killed the little factories in small towns in large measure. This new revolution is not simply a new mode of transportation; that is perhaps not the most important part of it. It is far more comprehensive than that. This new revolution has destroyed isolation.

Fifteen years ago there were millions of people in the country that were hopelessly isolated, so far as we could see. The government never did anything to bring them out. It sent them a newspaper occasionally by the postman and that was about all. But all of that isolation is gone, and it has been brought about by American industrialism that has been "cussed" so much. Life in the country under this new order has been revolutionized. It has taken place so quickly that we do not realize it. The people in the country can have every luxury and every convenience that belonged exclusively to the cities just a short while ago.

INDUSTRY SEEKS THE SOUTH

The little village out yonder, under this new revolution, is having practically all the advantages of the city, and thousands of advantages that the city cannot have. The city was built up because space was very valuable under the steam revolution. This new revolution has destroyed the value of space. There is no sense in jamming together now. Five miles is closer than a half mile a short while ago; and the quicker city people see this, the better it will be for them.

Just as soon as this new order came, industrial leaders commenced to relocate their factories. Take Tennessee—during this period we have had a number of big industries located in the state; I mean five, ten, fifteen, and twenty-million-dollar industries. Where did they go? They did not go to Memphis; they did not go to Nashville; they did not go to Chattanooga or Knoxville. Not a single one located in any of the big cities. A few years ago you would not have dreamed of anything else. But where are they now? They are chiefly in the moun-

tains of east Tennessee, the place that was considered missionary territory by our northern friends for a long time.

Some far-seeing men got together to establish a printing establishment, the biggest in the United States. Where are they going to put it? Under the old order, of course, they would have put it in Boston or New York. But those men had brains. They saw something had happened, and today the biggest printing establishment in America is at Kingsport in the mountains of east Tennessee. Also the Germans came to America to establish a great rayon plant. After looking around, they put it out in the country in east Tennessee, between Johnson City and Elizabethtown.

This Southeast has every economic advantage that I can think of as compared with almost any other section. The climate is a big factor; it brings down cost. The fact that a factory can be established in a rural district means a big advantage—the tax rate is cut by perhaps two-thirds. Not only that, but it gives the owners a chance to live close to their people, and they are taking advantage of this.

Under this new revolution, if you will go around in Tennessee, Virginia, and North Carolina, you will see the results of it. In nearly every town, you see a great smoke stack and factory.

A SPECIES OF ECONOMIC QUACKERY

One thing that is blocking this development is the repudiation of the American theory of the relation of government to business and the acceptance of the Socialists' philosophy. Now socialism operates under a number of names. But the philosophy back of the Constitution with reference to the relation of government to business is this—that it is not a proper function of government to direct business or to own and control business. Governments are not instituted for that purpose. It is only in extreme cases that a government is justified in owning a business. When a business activity is vital to the life of the people and is of such a nature that it cannot with safety be trusted to private hands, it should be operated by the government regardless of costs. The minting of money is a good example.

SPINNING DEPARTMENT OF LARGE MERCERIZING COMPANY, LUPTON CITY, TENN.

The Number of Industrial Plants in the South Is Steadily Increasing

But it is a proper function of government to regulate all businesses and see to it that all play the game straight. On the other hand the Socialists' theory is that it is not only a proper function of government, but the duty of government to direct the economic processes of business. That is where our fight is coming. The government does not regulate the railroads; it directs them. It tells them what to pay and what not to pay. That is not a proper political function of government; it is an economic function.

NIGHT VIEW IN CHATTANOOGA, TENN.

A Photograph of Market Street, the City's Principal Thoroughfare, Taken During the Christmas Season

It is important to draw this distinction, to show how illogical it is for the government to undertake to direct business. Direction of economic processes and fixing hours and wages is directing business. The regulation of business is a judicial function and belongs to government; the direction of business is a highly specialized economic function, and in no way belongs to government. It is just as illogical for government to take up the direction of business as it would be for government to take up the direction of surgery. Just think of it, the idea of a lot of politicians in Washington who do not claim to know anything about business, who have never had any experience in business, setting aside the greatest business specialists the world has ever seen and saying, "No, do it this way." This is destructive.

When the government undertakes the direction of business it is always quack direction, and bound to be. The quack is ignorant of the laws that govern an activity but he proceeds as if he understands the laws. If I were to direct surgery I would be a quack. It ought not to take any argument to prove that. The government directing business approves of murdering between five and six million pigs, weighing up to sixty pounds, and converting them into fertilizer and soap grease in order to help the masses of the people. The result is we are paying forty cents a pound now for breakfast bacon. That is pure economic quackery as I see it.

NATURAL LAWS MUST SURVIVE

Another obstruction to the return of real prosperity is very fundamental. It is an attempt to repudiate valuation by natural laws and substitute for it valuation by political management. The American theory is that all valuations—and that is the meaning of the freedom of contracts—must be determined by the natural laws of supply and demand. We buy and sell on the market; that means natural laws fix the value. We invest under the natural law of regulation of the business, and regulation of the value of money. Nothing has contributed so

much to industrial progress as taking away from government the power to fix values and putting it under natural laws. That is the American system. Men will trust natural laws, but business cannot trust any valuation that is under the contol of politicians.

It is hard to overestimate the development of this southeastern section with its thousands of advantages under American constitutional freedom. There is hardly any limit to it. If American ideals are maintained, people twenty-five years from now will be amazed at the enormous development of this section. If we repudiate the protection the Constitution gives to business, and change from the American philosophy of freedom of industry into socialistic restriction and direction, nobody can anticipate or prophesy as to what will become of the future.

Social and Economic Implications of TVA

By ARTHUR E. MORGAN
MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS
CHAIRMAN OF THE BOARD, TENNESSEE VALLEY AUTHORITY, KNOXVILLE, TENN.

THE American philosophy of government holds that our common life is too varied and too complex to be held within the confines of any abstract political creed. It holds that theories or doctrines can have very little authority or value except as they grow out of experience and are supported by experience. When a political or economic doctrine comes into conflict with widespread experience, the American philosophy holds that theory must give way and experience must be the guide.

In one field after another, the public has found it best to serve itself directly without private initiative being in control. Education was once a private industry conducted for profit. With the growth of education as a public business that old idea has almost faded away. When public education was taking root, it was bitterly attacked as radical and as destructive of the private rights of the private industry of school keeping. Private fire departments once were profitable. When a man's house was on fire it was a good time for the fire department to make a profitable bargain. But the public has taken over that work. Toll roads were once built for profit, but now the public owns the highways directly. Private toll bridges still exist, but public bridges are largely displacing them. City water supply is becoming less and less a private industry for profit and more and more a public business. Supplying irrigation water as a private industry has largely ceased. Tax collecting used to be a private business let out by contract. Furnishing hired soldiers to fight wars was once a profitable industry, but mercenaries have largely disappeared.

In view of this vast and ever-increasing experience of the public in business for itself, it is difficult to persuade the average American that there is something sinister and evil about public business and something divinely inspired and holy about private initiative.

The typical American is inclined to judge each case by itself. Where public business goes better than private business, he will expand public functions. Where it does not go so well, he will turn his business over to private initiative. I expect and hope that for many years to come public business and private business will be in competition. Where exploitation and monopoly become too great, the public will undertake to do its own work. Where bureaucracy, patronage, and red tape take the life out of public business, as they do all too often, the people will turn in disgust to private initiative. Where both government and big business fail them, the people may take business into their own hands through cooperatives, as the people of Sweden have done on a large scale.

There is another field in which the war of theories pulls us this way and that—the field of social and economic planning. Many liberal or radical people point an accusing finger at America and say, "There, see what a sorry mess you are in. Look at Russia with its wonderful five-year plans controlling the whole course of the economic life of a great nation. This is the way to the millennium." But the average American is not quickly convinced. He wonders what price in lost individuality must be paid for that extreme degree of regimentation. He remembers a brief millennium we had recently and wants a longer basis for judgment than is yet available.

Neither is he convinced, on the other hand, when one element in our population decries social and economic planning as a whole. For Americans have been planning for many years. We try to build public schools when and where they are necessary and not just as people

EROSION CONTROL WORK IN PROGRESS ON A HILLSIDE

25,000,000 SEEDLINGS IN ONE OF TVA'S THREE TREE NURSERIES

ask for them. We try to work out orderly highway plans for our states. We see far-flung planning of telephone companies, power corporations, aviation systems, ship lines, and banking groups. Social and economic planning is a vital part of our national life, and any effort to decry planning in general does not fit in with general experience and is distinctly not American. The practical American decides that sometimes widespread planning is justified; sometimes it is not. He will judge case by case and come to his conclusions with small regard to doctrines that would require him to plan everything, or with doctrines that would ask him to plan nothing.

Since the Tennessee Valley Authority has been organized, there has been criticism that it is revolutionary and radical because it is doing social and economic planning. It would be in accord with long-time American philosophy to look into the particular phases of this planning and to judge whether the particular undertakings are each sound and reasonable. I should like to mention some of the main features of TVA planning so that it may be judged whether that organization is filling serious gaps in our social and economic life, or whether it is engaged in theoretical abstractions.

UNIFIED RIVER CONTROL OF UNPRECEDENTED EXTENT

First, let me mention the unified control of the Tennessee River and its tributaries. Heretofore no river system of that size—about the area of Ohio or of England, and with a heavy rainfall and runoff—ever has been controlled and developed for all its uses. On the Catawba River in North and South Carolina, the Duke Power Company has worked out a completely unified

TERRACING A FIELD TO PREVENT EROSION

development for power with results, I understand, that reflect great credit on the technical skill involved in that great undertaking. The Tennessee differs from the Catawba in two important respects. First, it drains an area ten times as great, and so brings water control to new dimensions. Second, the reason for unified control is not just power development, but includes navigation and flood control. The unified development of the Tennessee will simplify flood control on the Ohio and Mississippi Rivers and will provide one of the chief sources for increased dry-weather flow for navigation.

Also it will provide effective navigation on the Tennessee itself of a quality which has never existed in America except on the Great Lakes. It is not an accident that Buffalo, Cleveland, Toledo, Detroit, Chicago, Milwaukee, and Duluth are on the lake shore. No short stretch of waterway is effective unless there are special conditions, as on the Monongahela; but given a uniform 9-ft channel joining Pittsburgh, Cincinnati, Chicago, St. Paul, Kansas City, St. Louis, and the Tennessee River cities, which plan is now approaching realization, with better navigation conditions in many respects than exist on the Great Lakes, inland navigation may reasonably be expected to be a reality.

A RECENT VIEW OF WHEELER DAM

Few people realize the extent to which the national freight-rate structure is deliberately arranged to thwart the industrial development of the South and West. Only by depressing the southern wage level is it possible to partly overcome this handicap. Nor do they realize the extent to which the normal use of our waterways has been deliberately blocked. Adequate river navigation is one way out of this dilemma.

The Tennessee Valley Authority did not originate the policy of making the Tennessee River navigable. That policy was established by the national government through Congressional action under a Republican administration before the TVA was born. But the TVA is endeavoring to make that development more than a haphazard growth. On the one hand we are making surveys and plans for a system of adequate river terminals at the most effective points and we are cooperating with the state highway commissioners to the end that a road system will be effective for collecting freight by truck for transfer to barges at the terminals. Similar studies are being made to coordinate water transportation with railway service, and to plan air line terminals in relation to all three. The aim is to help the development of a single integrated transportation system by water, rail, highway, and air.

While the Tennessee River system is viewed as an element in transportation, it also is considered as a source of power. The same dams which create a navigable channel and provide a water supply for its maintenance can also develop two or three million kilowatts of energy. How stupid it would be to throw away this great resource through lack of planning.

When we come to consider the power possibilities of the river, we see again the need for planning as contrasted with haphazard growth. The main river fluctuates greatly. At Wilson Dam and power plant at Muscle Shoals the flow has been so low as to provide less than 30,000 kw of power. It has been so high as to provide water enough for more than half a million kilowatts. To be an effective power plant it must be supplemented by river regulation above. Upstream on the Clinch River, a branch of the Tennessee, is Norris Dam. Taken by itself, this would be only a moderately good power development. But operated together with

Wilson Dam the picture is very different. The great storage capacity above Norris Dam makes it possible to hold back the entire flow from the 3,000 sq miles of the Clinch River watershed during the greater part of the year when there is abundant flow in the lower river. Then during the dry season, when power is most needed, the stored water used for developing power at Norris Dam will flow down the river and double the prime power capacity of the Wilson Dam power plant. There is room for six or eight dams on the main river below the Norris Dam, and each one will have its prime power doubled by relating its operation to that of Norris Dam.

But that is only the beginning of unified control for power. Above Wilson Dam on the Tennessee River, Wheeler Dam is now under construction. The Wilson Dam reservoir has only storage enough to regulate the flow for about 12 hours. Wheeler Dam has enough storage for two weeks' regulation and it can also absorb increased flow from small freshets on the river. By operating these three plants as a single system, the Wilson power plant can care for the daily fluctuations in load, the Wheeler Dam can provide for fluctuations during two weeks or more, and the Norris Dam can regulate the flow between winter and summer and between wet and dry years.

VIEW FROM THE PINNACLES AT CUMBERLAND GAP, TENN.

But unified control goes far beyond that. Pickwick Dam and power plant are now under construction on the Tennessee River fifty miles downstream from Muscle Shoals. Two other dams may shortly be under construction on the main river above and others on the tributaries. Taken altogether and operated as a single system, they will almost eliminate secondary power or dump power, and the entire flow of the Tennessee River, except for extreme flood flows, can be turned into prime power, and all as an incident to navigation and flood control.

As the rainfall varies over the different watersheds of the Tennessee system, some reservoirs will be filled while others are partly empty. Unified control will use the water wherever necessary to prevent waste. If a summer freshet on the main river provides abundant power for a few days, the power plants at the storage dams can be closed until they are again needed.

Private companies might agree to operate such power plants in unison, but they would not make the necessary initial investment to provide storage capacity which would not be profitable unless paid for by developments below. Even considering the scale of operations of our great industrial corporations, it is difficult to see how such unified control could be achieved otherwise than by governmental action.

RUGGED INDIVIDUALISM IN THE TENNESSEE FORESTS

Let us take another case—that of the forests of the Tennessee Valley. This and the surrounding region had the greatest body of hardwood forests that existed outside the tropics. Had the upland forests been well handled, as European forests are, they would have provided an indefinite supply of hardwoods and would have given support to hundreds of thousands of men in caring for the forests and in making forest products. The actual course pursued with the forests of the southern highlands might be classed as exhibit No. 1 of the disastrous results of the lack of planning and of rugged individualism.

The timber lands were purchased from the owners at very low prices by shrewd traders so that the farmer owners got almost nothing for their lands and homes. Then the mountain population was taken away from their simple farming and turned into timber workers at very low wages. Because of overproduction, many of the operators made no money, though a few became wealthy. Since the timber cost but little, it was wastefully cut. The growth of two centuries was consumed in a fifth of that time.

When lumbering was over, the working population was abandoned in poverty with little or no thought of social responsibility. A great natural resource that could have made the region prosperous for centuries was wastefully destroyed without bringing general prosperity to any class. The people left behind try to live by clearing and planting the steep mountain sides. After three to five crops, the soil washes away and they move on, and by clearing another steep slope they repeat the hard pioneering process of destruction.

That is one outcome of the sacred institution of private initiative, rugged individualism, and lack of planning. Where the TVA has acquired about 150 sq miles of rough cut-over land around one of its reservoirs, it is trying to gather up this wreckage to recreate forests and to set an example of a forest economy. Carefully selected workers are being thoroughly trained in forest work and are being trained as well in farming and home keeping so that they can live on the small farm patches in the forest. They will work about a hundred days a year for the forest to get necessary spending money and to pay rent on their homes. Then they can raise their food and perhaps carry on home industries using wood products. They will be protecting this property as a game and fish preserve (both game and fish are now practically destroyed); they will keep fire lanes open, put out fires, and cut out useless timber so the good timber can grow.

At the same time TVA foresters are teaching farmers how to care for their wood lots and are making a survey of the region to develop a forest policy. With reasonable support, they can reverse the process of rugged individualism and bring these wooded hillsides to a profitable forest economy supporting hundreds of thousands of people. That again is social and economic planning—to replace what private initiative has destroyed.

Let me give another case. Most of the lands of the TVA region were once very fertile. At one time, I am told, Tennessee stood first among the states in corn

production. Rugged individualism in farming has allowed the soil to wash away. Millions of acres are gullied and wholly abandoned, and from many other millions of acres the fertility has been largely washed away. Among the jobs given to the TVA is the production of cheap fertilizers. That job is being done, I believe, in an excellent manner from a research and manufacturing standpoint, but all that might take place without a vital contribution to southern agriculture. However, social and economic planning has intervened by cooperation of all the agricultural authorities of the region, and a new philosophy of agriculture is developing.

The hillsides were being destroyed by plow crops. They must be put into grass and other forage crops if the population is to be kept on the land. But in this region grass will not grow without nitrates in the soil, and nitrates cost too much to buy as fertilizer. It is much cheaper to produce nitrates in the soil by planting nitrogen-fixing legumes. Yet these will not thrive until the soil is enriched with phosphates. So we begin where we must, and the TVA has made great progress in producing cheap phosphates. This is not simply sold to farmers, but it is distributed through county agricultural agents and only to farmers who agree to use it in a new system of agriculture under direct supervision. While this is going on, terracing clubs are formed among the farmers, and tractor-drawn terracing machines are at work in fifty counties controlling runoff and preventing erosion. CCC workers are busy constructing stone outlets for the systems of farm terraces.

Gradually a radically new agricultural policy is being developed and soil destruction is being stopped. While this is going on, studies are being made of farm economy. Rural electrification programs are under way. Local industries, such as community refrigerating plants and drying plants, are being worked out which will enable farmers to process their products and have them available for winter use. If the TVA fertilizer and agricultural program can continue for a decade unhindered, the process of rapid destruction of an agricultural civilization can be stopped, fertility can return, and a new stability and prosperity can be given to this region. That again is social and economic planning. The entire nation has a stake in the outcome.

DIFFERENCES BETWEEN PUBLIC AND PRIVATE BUSINESS

Let me give one more case of social and economic planning in the Tennessee Valley Authority. The aim of industry is profits. Keen industrialists get business where the greatest profit lies. They avoid business where a considerable amount of management brings but small profits. If the post office were a private industry for profit, would we have rural free delivery in backward regions? Now when a privately owned utility is granted functions of government, such as the right to take the private land of others for its own uses, and is given monopoly control in municipalities, it is no longer free to use the method of getting profits where they come most easily. A different philosophy must control.

Yet the power utility business has too often been controlled by the same motives as private industries which have no monopoly and cannot use governmental powers. It has tried to get the largest profit with the least effort.

The TVA, in disposing of its surplus power, has endeavored to act as every utility should, primarily as a trustee of the public interest. In a utility business that exercises the functions of government, the only allowable profits should be reasonable compensation for management, fair interest on investment, and reasonable compensation for risk. If, in insuring necessary income, there is a choice between smaller unit returns from greater use on the one hand, and greater unit returns for smaller use on the other, public policy requires that given returns shall come from the lowest possible rates and from the widest possible use. Here is a sharp conflict between the allowable ethics of competitive private business, such as making women's hats, and a truly public business, like operating an electric power monopoly. We are coming to realize that all business engaged in employing labor and supplying human needs is "affected with a public interest," but utility services are especially and peculiarly so affected.

The electrical department of the TVA is working out a program of getting the necessary income from an electric power business by developing the widest possible use at the lowest possible rates. The results are surprising, even to ourselves. In most of the several communities where TVA power has been sold at TVA low rates the domestic consumption has doubled in 18 months even during the depression. In the largest of these community distribution systems, even at the low TVA rates, all costs have been met and 20 per cent of the initial investment has been repaid in about a year. In the town of Norris, 150 workmen's and supervisors' houses were fully equipped for electrical service, and power has been furnished at TVA rates. The result at the end of a year is an average consumption in these 150 houses of between 20 and 25 times as much current as is used in the average American electrified home. That is just a hint of the power market which awaits a sound utility policy.

Sometimes social and economic planning requires demonstration. The TVA is supplying it with reference to this field. About a year ago the head of the great private holding company which controls this region testified before a committee of Congress that over-production of electric power here is so great that even with extreme low water a third of the power capacity would be unused for years to come. This utility head testified that TVA influence had driven down the prices charged by his organization for electricity. The result is that the increased use in the territory of this holding company has been greater than in the country at large, so great that all past records have been exceeded, and even the old steam plants of that system are now being put into use trying to meet the demand.

ALONG THE TVA HIGHWAY LEADING FROM COAL CREEK, TENN., TO NORRIS DAM

My theme is this: Social and economic planning is not some vague theorizing about an ideal stage of society. It is the process of attacking live present issues that cannot be met or are not being met by uncontrolled private initiative, and of working out solutions which will serve the common good. The difference between civilization and savagery is social and economic planning. The TVA has dealt with such practical issues in a practical way.

Stretching the Highway Dollar

Careful Attention to Soil Properties and Construction Methods Is Necessary to Produce Low-Cost Roads of High Quality

NOT many years ago one read the weather reports carefully before setting out by auto for even a short trip "off the hard road." Horse-and-buggy transportation was still the standard in many a rural community long after the automobile became a dependable year-round conveyance in more thickly populated areas—and largely because of the excessive cost of hard-surfaced highways. But engineers have shown that, with proper treatment, the humble dirt road can be converted into a satisfactory all-weather highway at relatively low cost. Thousands of miles of such roads have already proved their value. In the first of the following articles Messrs. Hogentogler and Willis emphasize some of the important considerations involved in stabilizing soil roads. It has been impossible in the space available here to cover more than the highlights of their thorough treatment of this subject. In the second article, Mr. Webster describes how the State Highway Department pulled Tennessee out of the mud by the improvement of 3,000 miles of road in a single year. Both of these articles are abstracts of papers delivered on October 17, 1935, before the Construction and Highway Divisions at the Birmingham Meeting of the Society.

Stabilized Soil Roads

By C. A. HOGENTOGLER, ASSOC. M. AM. SOC. C.E.
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STABILIZATION is the process of giving road soils enough abrasive resistance and shear strength to accommodate traffic under prevalent weather conditions, without detrimental deformation. The methods employed include the use of admixtures, compaction, and densification. Admixtures other than water may be soil materials, deliquescent chemicals, solutions of electrolytes, soluble cementitious chemicals, primes and neutralizers, and insoluble binders.

Admixtures of soil materials are intended to provide a road material containing enough coarse aggregate to resist the abrasive action of traffic, a combination of coarse sand and fine sand in amount sufficient to provide the interlocking soil grains which prevent sliding, a quantity of silt to act as a filler and to provide the capillary bond necessary for stability when the binder clay loses cohesion in wet weather, and clay to retain the minute cohesive films after the larger capillary films have evaporated and thus provide stability during dry weather.

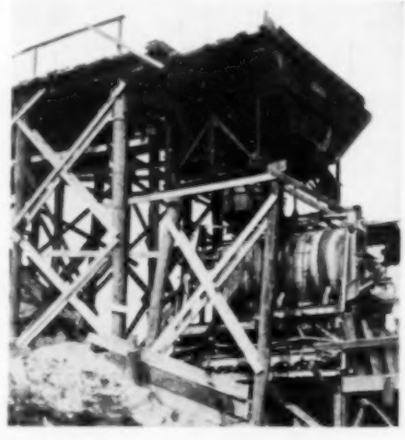
Materials falling within the following composition limits, by weight, satisfy these requirements and should produce good surfacing layers:

Passing	Percentage	Passing	Percentage
1-in sieve	100	No. 10 sieve	40–65
¼-in sieve	85–100	No. 40 sieve	25–50
No. 4 sieve	55–85	No. 270 sieve	10–25

It is the function of deliquescent chemicals to assist in maintaining that surface dampness which is so important in soil roads. Calcium chloride is the principal chemical used for this purpose. Magnesium chloride might also be of benefit. Such materials have the property of absorbing moisture from the air and slowing up the rate at which soils lose moisture between rains. Without proper grading of soil materials, deliquescent substances cannot be expected to furnish benefit other than possibly a laying of the dust.

Common salt is commonly but erroneously referred to as a deliquescent material. It is more properly a soluble binder which cements by crystallization during dry weather.

According to the theory of adhesion, the thinnest film gives the strongest joint for a given adhesive and given materials to be cemented. The thickness of films depends upon the nature both of the adhesive and of the materials to be cemented. A slight change in the electrolytic properties of the latter is sufficient to cause a considerable variation in the thickness of the film and consequently in the strength of the resulting mixture. It is the function of chemicals such as common salt, calcium chloride, and sodium silicate to facilitate the replacement of existing films of air or natural gels on soil particles with moisture or other adhesives in thin films of high strength. This benefit is additional to that furnished by the deliquescence of the calcium chloride and the crystallization of the common salt. Because of the electrolytic effect, surfaces treated with such materials acquire higher densities under traffic than similar soil mixtures not so treated.



MIXING PLANT FOR PREPARATION OF STABILIZED SOIL ROAD MATERIALS
This Plant Utilized the Clay Overburden and Stone from an Adjacent Quarry

USE OF SOAP PRIME INCREASES AFFINITY OF CERTAIN SOILS FOR BITUMINOUS ADMIXTURES

The use of admixtures other than soil in the stabilization of colloidal clay requires careful investigation. It is necessary that substances used to protect solids from

deterioration from natural environment, and adhesives used to bind solids together, be adsorbed more strongly by the solid then are the already present films of air, moisture, or other foreign substance. If this is not the case, the solids must first be coated with a prime.

Our knowledge of primes used in this connection is quite limited, although we have some information that certain soaps and portland cement washes may be effective in preparing the surface of troublesome soil particles to retain bituminous coatings permanently. Work of the Missouri State Highway Department discloses that some soils have greater affinity for water than for bitumen, in which case a soap prime is required to facilitate the wetting of the soils with the bituminous materials. The greater adhesion of the oil to the soap-treated soil was demonstrated when a heavy rain washed the soil from a mixture of earth, gravel, and oil constructed by ordinary methods but did not wash it from a soap-treated section.

The function of insoluble admixtures is to furnish films more substantial than those of moisture alone, thereby preventing detrimental volume changes in soil mixtures. Portland cement and bituminous materials are the best known admixtures of this type. Among other possibilities are dual treatments of sodium silicate and calcium chloride to produce insoluble calcium silicate; also dual treatment of ferric chloride and ammonia to produce the highly cementitious ferric hydroxide.

In this type of stabilization the thickness of the films is not so important. The insoluble admixtures are not intended to render the soil sufficiently hard or tough to resist the abrasive action of traffic, but simply to render the soil resistant to capillary water and thus to retain the bearing strength characteristic of the same soil in a dry compacted condition.

PORTLAND CEMENT MIXED WITH CLAY TO STABILIZE SOIL BASES

Research in the use of portland cement for stabilizing soil bases has recently been performed in South Carolina. During 1933 and 1934 seven sections of road, varying in length from 500 to 1,000 ft, were constructed in soil whose natural clay content ranged between 21 and 54 per cent. All were covered with bituminous wearing surfaces. The smallest amount of cement used was $1^1/_2$ sacks per cubic yard of treated material. There was no indication, however, that this was the minimum amount which could be used. The quantities were estimated for a compacted thickness of 6 in. of base course, although cores drilled from the experimental sections did not show that stabilization extended to this depth.

Experimental work in the treatment of soils with bituminous materials has been conducted recently in various parts of the country. During the past five years, plant-mix and road-mix jobs have been constructed utilizing the different grades of tars, road oils, and bituminous emulsions. In addition to the highways which have been so treated, airplane landing fields also have been stabilized with bituminous material.

To keep stabilized soil roads in the low-cost field, special attention must be directed toward simple operations and toward conditions and materials. In the following paragraphs I shall mention important factors in the best practice developed to date.

Loose sandy subgrades should be improved by the addition of soil binder; soft unstable subgrades by the addition of granular material. The additions should be harrowed in, after which the surface of the subgrade may be trued up by blading and rolling. Subgrades consisting of firm soil can be trued to final grade and cross section by blading or otherwise cutting. Material of this kind needed for binder in the wearing course can be bladed to the shoulders of the road and left in windrows during the preparation of the base.

THREE METHODS OF CONSTRUCTING GRADED SOIL LAYERS

Where the soil in the existing surface or shoulders does not meet the requirements for stability, the deficiency should be corrected by the proper admixture. There are three methods used in the construction of graded soil layers; plant-mix, road-mix, and stage construction. The essential features of a plant-mix job are a source of satisfactory binder close to the supply of coarse aggregate, means for drying and pulverizing the binder, apparatus for measuring the quantities of binder and aggregate to secure the proper proportions, and equipment for thoroughly mixing the combined materials—either a pug mill or rotary type mixer.

MIXING AND LOADING AT THE PIT
Overburden and Gravel Are Mixed in Proper Proportions and the Large-Size Aggregate Removed During Loading

An ideal location for a mixing plant such as is shown in an accompanying illustration is one at which the overburden consists of a clay soil possessing properties satisfactory for binder purposes. This overburden may be stripped and stock piled in windrows so that it will dry sufficiently to be pulverized under a roller. The clay should then be placed in a bin and combined with an aggregate of proper grading in such proportions that the resulting mixture will conform with the desired specifications. In some instances plant mixes have utilized bank-run gravel with the existing overburden and have eliminated the drying and pulverizing steps by passing the combined materials through a rotary screen which removes all over-sized material.

The mixture as it comes from the plant is hauled to the road, spread, sprinkled, shaped, and rolled. The principal advantages of the plant-mix method are greater uniformity and more thorough mixing of the binder and aggregate.

The necessary equipment for mixing on the road includes tractor-drawn or self-propelled bladers supplemented by scarifiers and apparatus for mixing, moistening, spreading, and compacting.

The existing surface should be scarified just deep enough to eliminate all irregularities and permit reshaping and adjustment to grade. After the loosened material is trued up, the entire surface should again be scarified so that if the loosened material were bladed away a true base surface parallel to the newly conditioned surface would result.

New material, if required, should then be spread in sufficient amount to furnish a compacted layer of three inches. Where greater surface thickness is desired, additional layers should be constructed.

The "cut-and-try" method of road construction has been used extensively in the so-called "stage construction" and "traffic-bound" roads. Essentially it consists of adding granular materials to surfaces which be-

come excessively muddy during wet weather and adding clay soil to loose sandy and gravelly materials.

During the period of compaction, the loose material should be kept distributed over the road surface by means of a road drag or blader. For this purpose a crown of about $^3/_4$ in. per ft should be maintained. Pitting of the surface indicates that the crown is too slight.

FINE-GRAINED SOILS MUST BE DENSIFIED DURING CONSTRUCTION

In the stabilization of fine-grained soils, a predetermined degree of densification must be obtained during construction, instead of depending upon traffic to produce the maximum density afterward as in the case of graded mixtures. Bituminous surface treatments should be used to provide fine-grained soil roads with the resistance to abrasion and softening under traffic furnished by the coarse aggregate in graded soil mixtures.

When only water or electrolytes are used as admixtures, the soils should be densified by means of a sheepsfoot roller, or apparatus giving similar effect, at optimum moisture content and to a density indicated by the Proctor tests. Construction methods with admixtures of portland cement and bituminous materials may not be so critical. In the South Carolina work already referred to, the cement was spread on top of the pulverized soil at the rate of about one sack per linear foot of roadway. Mixing of the dry soil and cement was done with disk harrows supplemented by a disk plow or road machine. Water was then added at the rate of about 80 gal per lin ft, and compaction was accomplished by means of loaded dual-wheel trucks. The surface was finished with a road machine after compaction. A bituminous surface treatment was applied subsequently to protect against surface abrasion. All the experimental sections are in good condition at the present time and no disintegration has been observed.

Current practice in the construction of stabilized soil roads with bituminous emulsion is illustrated by a project in Solano County, California. Laboratory studies indicated that the natural adobe clay soil could be stabilized to a depth of 3 in. with about 3 gal of 55 per cent emulsified asphalt. However, by adding two parts of quarry waste to one part of the black clay, stabilization was accomplished with one gallon of emulsion per square yard—a saving, after paying for the quarry waste, of about 5 cents per sq yd.

This road was not closed to traffic at any time during construction. When completed, it resembled bituminous macadam in appearance. It has come through the rainy season in perfect condition although the subgrade was saturated and plastic.

Low-Cost Road Construction in Tennessee

By FRANK W. WEBSTER

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IN the spring of 1923 there were 4,000 miles of road designated as "state highways" in Tennessee, but the sections on which work had been done were widely scattered, relatively short, and the net value to traffic was almost negligible. Prior to 1915, the various counties of eastern and middle Tennessee had constructed quite a large mileage of county roads, mostly of water-bound macadam. Their graded width varied from 16 to 26 ft, and the surface width from 9 to 16 ft. They had not been effectively maintained, and all of them were in extremely bad condition, full of pot holes, and so rough that it was impossible to travel in excess of 15 or 20 miles per hour on them, and then only at great discomfort. These macadam roads were not continuous, so that on practically all state routes there were unimproved dirt sections.

Almost no surfacing had been done in western Tennessee and in that section the roads were absolutely impassable in wet weather. In middle Tennessee there were numerous toll roads in the state system. Added to all this, there were scattered throughout the entire state numerous short sections of construction, under way as federal-aid projects, with the roads torn up and no detours. In wet weather it was impossible to travel by auto between any of the four major cities of the state—except between Chattanooga and Knoxville, a distance of 120 miles, which required about 10 hours to negotiate.

Naturally, the public demanded roads over which they could travel with comfort and speed. It was quite apparent to the Highway Department that no program of high-type construction could be devised to care for the situation; neither time nor money was available for such work. Rapid low-cost construction and reconstruction, followed by adequate maintenance, was necessary.

In 1923 the legislature passed a two-cent gasoline tax. There were also available the receipts from the automobile license fees, and federal aid, which at that time amounted to about $1,500,000 per year. The Department determined to limit its high-type construction program to federal-aid work and to use the remainder of its revenues, amounting to about $5,000,000 per year, on low-cost work to provide a serviceable, smooth, all-weather system of 4,000 miles of connected roads.

In the fall of 1923 two trunk-line routes in eastern Tennessee, one connecting Chattanooga and Knoxville and the other connecting Knoxville and Bristol, were selected for the first experimental work. Both of these routes were already macadamized, but the surface was narrow and very rough. Some sections were scarified and smoothed out, and new material was added; others were merely dragged daily, using a small amount of floating material composed of fine crushed limestone. A finished job was not obtained, as the expenditure on these two roads, during this experiment, averaged less than $500 per mile, but the improvement in the condition and riding qualities was so tremendous that it was decided, in March 1924, to immediately apply similar but more complete methods of reconstruction and maintenance on the entire state system. This program was undertaken entirely with the state's own forces and equipment.

GENERAL RECONSTRUCTION METHODS

Where the existing road was of narrow, rough, water-bound macadam, the graded width of roadway was increased by the use of large crawler tractors, graders, or scrapers. A small grading outfit, which generally carried two 60-hp crawler tractors, two large graders, a scarifier, and several wheel scrapers, widened the existing grade to about 26 ft from shoulder to shoulder. This outfit also scarified the existing macadam and brought the whole

roadway to a true cross section, at the same time eliminating bad longitudinal waves. Another outfit lengthened the existing culverts and installed additional drainage where necessary. Immediately after widening the grade and scarifying the surface, crushed limestone, all passing a $1^1/_2$-in. round screen and containing dust, was spread on the roadway to a uniform width of 16 ft and an approximate depth of $1^1/_2$ in. This required approximately 400 cu yd per mile. An additional 100 cu yd per mile was stored in piles for one year's maintenance.

One of the most interesting and important operations was the production of the crushed limestone. Most of the work was done with portable 15 by 24-in. jaw crushers. Since limestone was abundant, and conveniently located on almost every job, these crushers were set up and operated at points adjacent to the work and about five miles apart, thus requiring an average haul of about $1^1/_4$ miles. Approximately 25 men, on the average, composed the quarrying and crushing crew. Pneumatic air compressors, ranging in capacity from 100 to 220 cu ft, were used for drilling. After drilling and shooting, the material was loaded by hand into small carts and transported to the crusher. The crushed material, after screening, was hauled to the road in trucks. An average of 120 cu yd of crushed stone per 9-hr day was produced at each of the plants, at an average cost at the plant of 90 cents per cu yd. The delivered cost was $1.15 per cu yd. The state owned approximately 75 crushing units of the type just described.

A LOW-COST BITUMINOUS ROAD NEAR DOVER, TENN.
Complete Except for the Seal Coat

For unsurfaced roads, either partially graded or unimproved, the work was similar to that on old macadam roads, except that more grading and drainage was necessary and the surfacing was applied in two layers, each about $1^1/_2$ in. thick, the first layer being thoroughly compacted by traffic, under maintenance, before the second layer was applied. Roads of this type were built on surveyed alignment, using a rolling gradient and a type of location that secured reasonably good alignment at low cost. No great expense was undertaken to secure the best permanent location, but the type of location that would permit of the cheapest construction consistent with the elimination of dangerous alignment was selected. On such new grades, it was necessary to apply from 600 to 900 cu yd of crushed limestone per mile.

WORK IN WESTERN TENNESSEE

In Western Tennessee most of the roads were very narrow and excessively crooked, and practically none of them were surfaced. The trunk line routes were widened out, relocated where most necessary, equipped with new drainage facilities, and surfaced with 600 to 900 cu yd of imported chert or gravel per mile. Since it was necessary to ship by rail, and since long hauls from the railroad to the highway were usual, the average cost of this material delivered on the road was about $3 per cu yd; construction was therefore much more expensive in western Tennessee than in other parts of the state.

The average cost of this program of construction and reconstruction was approximately as follows:

EASTERN AND MIDDLE TENNESSEE

Reconstruction of old macadam roads:	
Grading and drainage	$1,000 per mile
Limestone (500 cu yd @ $1.15)	575
Total	$1,575 per mile
Reconstruction and new construction of old earth roads:	
Grading and drainage	$2,000.00 per mile
Limestone (750 cu yd @ $1.15)	862.50
Total	$2,862.50 per mile

WESTERN TENNESSEE

Reconstruction and new construction of old earth roads:	
Grading and drainage	$2,500 per mile
Gravel or chert (750 cu yd @ $3.00)	2,250
Total	$4,750 per mile

This entire program was started in the spring of 1924 and was pushed forward so rapidly that one year later the state highway system contained approximately 3,750 miles of smooth, all-weather roads, which were maintained in excellent condition at all times by constant, daily dragging. Approximately 3,000 miles of state roads had been reconstructed, surfaced, and maintained at an approximate total cost of $6,000,000.

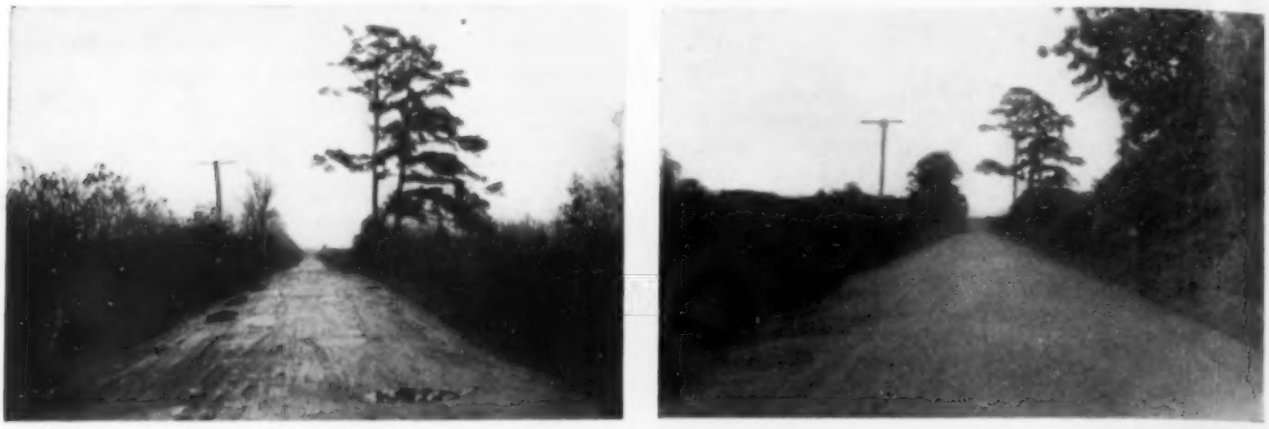
It was now possible to travel safely, speedily, and comfortably from one end of the state to the other, and between all important centers of population, whereas one year earlier no such trip was possible at any point in the state for a continuous distance of as much as 40 miles. An immediate result was an enormous increase in motor vehicle travel. But with this increase the new trunk line route, within a month or two of its completion, became so extremely dusty that although speed was still possible, safety and comfort were out of the question on account of the enormous dust clouds.

This immediately created another problem for the Department to solve. It was evident that the traffic-bound macadam road would not do for main-line travel, and that some other types of pavement would have to be devised, or that oiling or the application of chemical dust preventative would have to be resorted to. The Department has experimented with all these methods and has concluded (1) that where funds are available and the volume of traffic is great enough to justify pavement, concrete or other similar type of hard surface is desirable; (2) that where a hard surface is justifiable on account of traffic needs, it should be of the more durable, expensive type, such as portland cement concrete; (3) that the type of surface to be used when a hard surface cannot be either justified or financed, on roads having a traffic in excess of 300 vehicles per day and less than 1,000 per day, should be a mixed-in-place surface of the type to be described later; and (4) that plain traffic-bound macadam, untreated, is suitable for roads having a traffic of less than 300 vehicles per day.

It is not necessary in Tennessee to have more than 2 in. of traffic-bound macadam or gravel to hold up the loads under all weather conditions, if there is proper maintenance. Many such roads have carried from 700 to 1,000 vehicles per day through all seasons of the year.

The standard intermediate type used in Tennessee is the road-mix surface. This is built on a carefully prepared traffic-bound macadam base, built up in layers

about $1^1/_2$ in. thick. Each layer is maintained by dragging until the whole surface is properly compacted before the next layer is added, the process of adding stone and dragging continuing until a total of approximately 2,000 cu yd of limestone per mile is included in the base.



TENNESSEE STATE HIGHWAY NO. 2, BEFORE AND AFTER RECONSTRUCTION
3000 Miles of This Sort of Improvement Were Completed in a Single Year

The material will not make up or bond except during the winter, and two full winter seasons are usually required to bond 2,000 cu yd per mile. During all this time the surface is carefully maintained by dragging under traffic, so that every square yard of the surface is dragged each day. The drag is usually a rubber-tired one-man grader weighing 12,000 to 14,000 lb. All weak places in the subgrade are automatically strengthened by the maintenance process and the final completed base has remarkably high bearing power.

The surface applied to this base course is approximately 1 in. in thickness, and is composed of crushed limestone and cold bituminous materials. The limestone is of two sizes, one size consisting of particles passing a 1-in. square screen and retained on a 4-mesh screen, and the other size being stone chips passing a $^1/_2$-in. square screen and retained on a 10-mesh sieve. Three grades of bituminous material are used: (1) a light tar for the prime coat; (2) a cut-back asphalt, cold tar, or asphalt emulsion for the mixture; (3) hot asphalt or tar for the seal coat. The tar used in the prime is a light, highly penetrating material having a specific viscosity of 6 to 15. The cut-back consists of asphalt with a penetration of 80 to 105, cut with 30 per cent of naphtha. Cold tar for the mix has a viscosity of 27 to 35. Emulsion for the mix is approximately 55 per cent bitumen and 45 per cent water. Hot asphalt, used in the seal coat, has a penetration of 150 to 200. Hot tar for the seal coat has a specific gravity of not less than 1.18.

In constructing the surface, the base course is first swept clean of all dust, dirt, and loose stone, and a prime coat consisting of $^1/_3$ gal cold tar per square yard is applied uniformly with a pressure distributor. The material is applied in one application and allowed to soak into the road for at least 48 hours. Any bare places or pot holes that develop during this time are carefully patched with pre-mixed material. The larger stone is then spread uniformly over the primed base at the uniform rate of 80 lb of stone per square yard. The loose stone is then brought to a true and uniform surface by light grading.

Bituminous material is then applied to the surface of the loose stone, at the rate of from 0.4 to 0.6 gal per sq yd, the exact amount being just sufficient to thoroughly coat each particle of stone. The stone is then windrowed to each edge of the road by means of the one-man grader and by at least three grading operations. These operations are then repeated three more times and all the material returned to a windrow in the center. It is then spread out in a uniform layer over the entire road surface, the final spreading being performed at a time when the material has reached the proper consistency to take a permanent set. Great care is taken to see that the final layer is perfectly uniform and of true contour and cross section. Traffic is allowed over the road during all these operations

The surface is then rolled thoroughly with a 5 or 10-ton three-wheel power roller, and any irregularities or depressions which develop during rolling are carefully patched with pre-mixed material. Stone chips are then applied to the surface at the rate of 6 lb per sq yd, and thoroughly broomed into the voids of the surface mixture. This operation is followed by an application of 0.3 gal of hot tar or hot asphalt per square yard, and immediately thereafter the entire surface is covered with 25 lb of stone chips per square yard. These chips are continually moved by a broom attached to the roller, while the entire surface is being thoroughly rolled.

The completed surface is remarkably smooth, uniform, and pleasing to ride on. The average cost of an 18-ft surface, including base, has been as follows:

Base (2,000 cu yd limestone @ $1.15)	$2,300 per mile
Maintenance of base course (1 year during construction)	350
Surface (11,000 sq yd @ $0.25)	2,750
Total cost	$5,400 per mile

The Department constructed the first roads of this type in 1925, and has consistently added to this mileage since then until at present 1,900 miles have been completed. These roads have given most excellent service. The average cost of maintenance has been about $350 per mile per year, which is only about $100 per mile per year in excess of the maintenance cost of the highest type of pavement. It is believed from our experience in Tennessee that resurfacing will be necessary on the average of about every seven years. Considering everything, this has proved a most serviceable, satisfactory, and economical type of road, rendering traffic service comparable in every way to the highest types of pavement, at a small part of their initial construction cost and at a very little higher maintenance costs. These surfaces are now satisfactorily carrying traffic of between 250 and 1,000 vehicles per day.

Developments in Highway Bridge Design

Discarding Rules of Thumb Permits New Era in Design to Be Inaugurated

By H. H. Houk

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AMONG the myriad unforeseen results of the motor age has been the early obsolescence of many highway bridges. In replacements as well as in new construction, advances in the design of statically indeterminate structures and heightened esthetic appreciation are together responsible for the marked progress in highway bridge design witnessed in recent years. The undue importance given to precedent has hindered improvements here just as in many another field of endeavor. The practical aspects of the present situation and indications of future trends are ably presented in this article, abstracted from the paper presented by Mr. Houk before the Structural Division on October 17, 1935, at the Birmingham Meeting of the Society.

THE amount of money expended for ordinary highway bridges is far in excess of that expended for our few great monumental structures, and it may be said that more public money can be saved through the analysis of suitable bridge designs and the selection of economic types than the average engineer out of touch with such matters would think possible. Such a large percentage of existing highways remains to be modernized and so many miles of new ones remain to be built that the potential economies and improvements are a challenge to highway bridge engineers.

Automobile traffic has increased more quickly and to a greater degree than anyone could have foreseen. As a consequence, in many localities the bridge engineer is now confronted with the fact that good judgment and sound economy have been the exception rather than the rule in the past. Totally different types were used in the various states for structures under almost identical conditions, for no apparent reason except that the designers were following an earlier type existing in that locality.

A STUDY OF EACH PROPOSED BRIDGE AS AN INDIVIDUAL PROBLEM IS DESIRABLE

In the early development of highway bridges there was a lack of understanding of how to select the proper types and designs. Under pressure of public demand for immediate construction of roads and bridges, many engineers were forced to use light loadings and narrow roadways because the funds at their disposal were so limited. Following precedent, they selected bridge sites where the cost of the bridge itself would be a minimum, without giving due consideration to the resulting length of bridge and tributary road and the economics of road alignment.

Increase in weight and numbers of motor trucks, coupled with 20 years of experience, has now resulted in a clearer conception of what constitutes real economy, and closer attention is given to the fundamental principles involved in selection of types and detailed designs. Engineers now consider a bridge only as a section of highway that costs more per unit of length than the average section. They no longer hesitate to use a skew bridge, or one on a horizontal curve or on an inverted or concave vertical curve, if necessary to maintain highway alignment and grade.

They also have come to face the fact that bridges are subject to early obsolescence, like all other man-made structures. A structure is now considered permanent enough if it serves economically as long as the service it provides is satisfactory and necessary, which may be for only a few years. The highway bridge engineer is now generally able to gage future traffic requirements intelligently, and, where there is likelihood of abandonment, can provide a structure having a corresponding service life, can design it with an eye to salvage value should it become obsolete, or can provide a bridge capable of being remodeled with minimum loss of materials and expenditure of funds.

Before selecting a permanent type of structure, the engineer should be reasonably sure that the highway itself will be permanent and that the location, grade, and alignment will be satisfactory for the next 50 years. The abandonment of costly concrete or steel structures

Reinforced Concrete Arch of 100-Ft Span
This Attractive Highway Bridge Illustrates the Results Which Can Be Obtained by Clear, Simple Treatment

that are in good condition is not only wasteful but often very embarrassing to those responsible.

ESTHETIC CONSIDERATIONS HAVE BEEN FAR TOO MUCH NEGLECTED IN PAST

In general, very little attention was paid to esthetic considerations in the past. America has probably earned the reputation of having the most unattractive bridges in the world, because until recently work of real architectural merit has been confined to a few of the larger structures. But with highway development, there has come the desire for bridges of more artistic design, and purely utilitarian structures no longer satisfy the public. Those engineers who appreciate form as well as utility are today bringing artistic development of structures abreast of the knowledge of stresses and materials, often in cooperation with the architects.

SOME ENGINEERS STILL USE THE PONY TRUSS
Note the Obstruction to Vision and General Inartistic Effect Thus Produced. This Bridge, with 18-Ft 6-In. Spans, Carries a 24-Ft Roadway

Much improvement can still be effected by proper regard for the fundamental principles of esthetics. It is surprising how many bridges have been designed without regard to symmetry, when attractive structures could have been built if the lines, proportions, treatment, and ornamentation had been in harmony with the setting.

Many advances in structural design have been made in recent years, due in large measure to the activities of the engineering colleges on the one hand and the work of the engineers of the different highway departments working in cooperation with the U. S. Bureau of Public Roads on the other. Much investigation has been carried on, with the result that specifications have been considerably standardized during the past decade. Provision has been made for increased truck loadings and higher allowable unit stresses. Live loads adopted and approved by the U. S. Bureau of Public Roads, the American Association of State Highway Officials, and the American Railway Engineering Association establish selective standards for the needs of each locality.

The theories of bridge design have been vastly extended in recent years, and texts dealing with almost every phase of this subject are now available. Stresses can be more accurately calculated and a greater percentage of the known ultimate strength of structural materials utilized.

WIDE USE OF STATICALLY INDETERMINATE STRUCTURES

There is an increasing tendency toward the general use of continuous superstructures and statically indeterminate forms. I am glad to note that most American designers are abandoning their former pessimistic attitude toward structures uncertain in analysis or behavior. Pin friction often produces appreciable bending in joint members even in pin-connected trusses. Although the average concrete or steel superstructure is generally considered as made up of simple elements, conditions of restraint are frequently imposed at one or more points, and it is usually more economical to recognize and design certain parts of the structure as continuous or restrained, as the case may be.

In recent years, methods of analysis of the more common forms of indeterminate structures are becoming better known. Mechanical and photoelastic methods of checking stresses in celluloid, metal, or glass models of complex statically indeterminate structures have enabled the designer to visualize the behavior of every part of the structure under various conditions of loading. The use of these models has given designers confidence in analytical results and has greatly encouraged the use of indeterminate structures.

There has been great improvement in the design of bridge details. In the haste to provide modern highway bridges, designers frequently gave undue attention to facility and economy of construction, ignoring the study of details, and much unnecessary maintenance expense is now being incurred as a result. Engineers with maintenance experience design the best details because the importance of this feature is impressed upon them when they attempt to correct inadequate provision for expansion and contraction, to repair unsightly cracks in concrete structures, or to preserve and paint metal in inaccessible pockets.

All highway departments prepare standard designs of the simpler bridge types for use under given conditions, but when the selection and arrangement of spans is left to subordinates they often use them where ill-adapted and uneconomical. Today it is no longer the practice to use standard plans, except for strictly utilitarian structures in unimportant locations. Standardization reduces the probability of architectural fitness. Individual consideration should be given each location, since no two sites are truly identical. Bridges are being treated more and more as special problems, and each is designed and given such architectural treatment as is felt to be justified.

BRIDGE WITH CONCRETE FLOOR, STEEL STRINGERS, AND TIMBER PILE SUPPORTS
A Bridge Should Be Designed with an Eye to Its Expected Economic Period of Service. High Curb and Low Handrail Add to Utility and Appearance

The so-called standard width of bridge roadways has steadily increased to give greater safety to traffic and to the structure itself. Evidences of collision may be seen on almost every narrow bridge railing. Twenty-foot roadways no longer suffice for the shorter bridges. On longer bridges, where traffic is comparatively light and the traveler receives the impression that special care must be exercised in crossing, a 20-ft roadway may be sufficient, but short bridges should have a roadway wider than the paved width of the approaches. On the open road, bridge roadways should be the full width of the road, including the shoulders.

IMPROVED TYPES OF BRIDGE FLOORING

Continuity of the roadway is necessary if a bridge is to render its full measure of traffic service. Great improvement has been made in the design and construction of bridge floors so that riding surfaces are today usually equal or superior to those of the approaches. Ten years ago, highway bridge floors were defined as a "sub-floor with the necessary strength to carry the loads, and a wearing surface." While advocating the use of reinforced concrete slab and integral wearing surface, I was once told in committee meeting that it was impossible to secure a satisfactory riding surface on monolithic slabs because of form settlement and difficulty in finishing, and that slab floors must be paved with separately placed concrete or other type surfacing. However, the vibration of loose and shrunken planking and the resulting rupture of bituminous surfacing placed on timber sub-floors led me, in 1924, to place reinforced concrete slabs on timber stringers of timber trestle spans. Rows of spikes were driven in the tops of the stringers to transmit horizontal shear.

Unless the concrete floor slabs on bridges are kept reasonably thin, the design becomes uneconomical owing to the increased dead weight. Rational methods of design, following the analyses of H. M. Westergaard, M. Am. Soc. C.E., have been generally accepted for determining slab thickness and are rapidly replacing the earlier "rules of thumb." However, many engineers still fail ot realize that a wide, continuous, reinforced-concrete floor gives so much rigidity by gripping the upper flanges of the stringers that a lateral system of truss

REINFORCED CONCRETE DECK GIRDER BRIDGE, BIRMINGHAM

Bridge Engineers Today Do Not Hesitate to Make Use of Inverted or Concave Vertical and Horizontal Curves, with Superelevation Where Required. This Bridge Accommodates a 40-Ft Roadway and Two 6-Ft Sidewalks, Providing Ample Capacity

bracing in the plane of the floor becomes superfluous. Personally, I fail to see how any appreciable distortion of the rectangles so braced can possibly occur, and find no need for such bracing after erection.

Precedent has played all too great a part in the development of bridge design in this country. What was thought to be good practice, and often was really out-of-date practice, has strangled initiative and checked normal design development. I was once practically accused of heresy by engineers and contractors alike because I placed a concrete floor on a treated timber structure. No specific reason for objecting was advanced except that it wasn't fit and proper to mix the permanent

A THREE-SPAN CANTILEVER BRIDGE WITH CONCRETE DECK ON STEEL GIRDERS

Spans Are 52 Ft, 74 Ft, and 52 Ft, Respectively. The Suspended Span Is 55 Ft Long. The Piers Here Shown Are Heavier Than Necessary

with the temporary. Almost as much furor was caused when I placed a concrete floor on steel stringers supported on timber trestle bents. Even laymen protested that.

RULE-OF-THUMB SPECIFICATIONS UNDESIRABLE

When I started to practice bridge engineering in this country, the low or pony truss was in general use for spans of from 30 to 100 ft despite its objectionable features. In searching for a deck-type substitute, I was confronted with "rule-of-thumb" specifications such as "rolled beams may be used for spans under 30 ft" and "the depth of rolled beams shall not be less than one-fifteenth of the span." When opportunity offered, I built a span of 50 ft, using 30-in. beams (the deepest section rolled at that time), and found the deflection to be much less than computed or expected, due to the restraint of the concrete slab. This structure served as a lever to secure government approval of longer spans, until, today, deeper wide-flanged beam sections are in general use throughout the country. These have superseded the pony truss.

Continuous spans exceeding 100 ft in length have been built with 36-in. beams. Thus, much economy has been effected, not so much in reducing the quantity of steel, but in lowering fabrication and maintenance costs. When used for long spans and an appreciable deflection is expected, these wide-flanged beam sections can be cambered at the mills with sufficient accuracy. The use of a concrete floor slab and light protective encasement renders such beam spans suitable for locations where the steel is subjected to destructive atmospheric exposure. It has long been known that encasement increases the carrying capacity of beams, but standard specifications as well as many engineers still deny proper allowance for this increase.

Formerly through girder spans in steel and concrete were widely used, generally because they require little headroom, and sometimes because they were thought to possess architectural merit. I have only two such to my discredit, both concrete grade-separation structures. This type is rarely used now, because appreciable widen-

ing practically requires reconstruction. The use of simple types of trusses is increasing, and many of the earlier complicated forms have been abandoned. Deck spans are used wherever practicable and through trusses are avoided except for long spans.

If possible, each bridge should afford a free and unobstructed view from vehicles. Many of our earlier bridges were so constructed that the traveler's view of his surroundings was cut off by a high massive railing or truss members. In the horse-and-buggy days, railings had to be built high enough so that the horse could not jump over when frightened by the rattling of the bridge and its floor. Years ago I attempted to have the minimum height required by the ordinary specifications reduced, and as others joined in the plea, the minimum height required was decreased from time to time. However, the present standard requirement of three feet above floor or sidewalk is still too high, as the function of the railing today is to prevent vehicles and pedestrians from falling from the bridge.

A HIGH-LEVEL BRIDGE OVER THE TENNESSEE
One Three-Span Continuous Truss and Four Simple Spans Make Up This 1,566-Ft Structure. The Approach Spans Are Carried on Wide-Flanged I-Beam Girders. Note Tall Reinforced Concrete Piers

ECONOMIC STUDY NEEDED FOR PIER AND ABUTMENT DESIGN

There has been a notable increase in the use of high-level structures over navigable streams. Of our 15 toll bridges in Alabama, 12 are fixed, 2 are hand-operated swing spans to accommodate government dredge boats that usually make only one trip per year, and one is a vertical lift over a section of river that is rarely used for navigation. In rural locations, it has been found that the high-level structures can often be built at less first cost and with marked decrease in maintenance and operation expense, even with the necessarily longer approaches and higher piers.

While there has been great advance in the field of pier design, many engineers continue, regardless of location and conditions, to design concrete piers as though they were of the old stone or brick masonry gravity type. Where foundation and local stream conditions are favorable, considerable saving can be accomplished by the use of reinforced piers of the pedestal type, which are more graceful in appearance and more scientific in design. Some of the reviewing engineers and contractors were shocked at the slenderness of the piers I have used on such rivers as the Tennessee and Tombigbee, but failed to give any reason except to refer to the "rules of thumb" for batter, which were formulated to guide the designer of masonry piers half a century ago. I also hope some resourceful engineer will develop a satisfactory and economical abutment design. When seeking economy this expensive element of all bridges remains the despair of every bridge designer. Most textbook writers do not attempt a method of analysis.

There is a fuller knowledge of the principles of arch action and better methods have been developed—or rather introduced into practice in this country from Europe—for determination of the proper axial curve for a given loading, making possible the utmost economy in arch ribs. The most complete discussion of this problem (with the exception of the great German work of A. Strassner) is found in the "Design of Symmetrical Concrete Arches," by Charles S. Whitney, M. Am. Soc. C.E., published in the TRANSACTIONS of the Society, Vol. 88 (1925), page 931. The open spandrel with its light dead load and greater certainty of actual arch stresses is supplanting the filled spandrel type for all but small-span arches of small rise. Further decrease in dead load and consequent economies are possible through the use of continuous stringers and light-weight concrete roadway floors. High-strength and rust-resisting alloys are now available to the designer, and there is much opportunity for further development and improvement in metal bridges. Structural aluminum shapes have been used in adapting bridges to increased traffic loads. An inexpensive rust-proof alloy will in all probability be perfected in the near future to a point where metal bridges will really be permanent.

The designer still has ample opportunity to exert his ingenuity in concrete. American engineers have had the impression that labor costs were too high for them to undertake designs of the delicate and exacting character used by European engineers, but present economic conditions seem to justify the use of types similar to some that have been used with success abroad. With the increased knowledge of the preservation, design, and handling of treated timber, wood can now be used to better advantage.

Last but not least in importance, more attention should be given to obtaining reliable information on the bearing power of soils and the fundamental principles involved in the design of foundations. Methods of investigation and equipment have been improved for the survey of soil conditions, and more adequate foundation surveys can now provide the designer with the essential information concerning subsurface conditions.

Certainly the highway bridge engineer should now be able to select and design a bridge to fit the location and provide economical traffic service.

Current Sanitary Work in the South

Outstanding Projects That Will Safeguard the Public Health of Both Urban and Rural Areas

WHEN a sewage disposal works at Atlanta, Ga., became overloaded, a 1/2-mgd experimental plant was installed to determine the most economical method of increasing its capacity. The tests, still in progress, indicate that by the proper use of chlorinated copperas the filter rate of the existing works can be tripled. This investigation is reported by Messrs. Singleton and Frith in the first of the following articles.

At Birmingham, Ala., a chemical precipitation plant was built in 1934. Important reasons for the selection of this type of treatment were the wide variation in flow of the receiving stream and the sudden changes in character and volume of plant influent. These and other factors are outlined by Mr. Hendon in the second article.

Aerial, surface, and submarine attack all have a part in the war against malaria. Airplanes and boats are being used by TVA to apply larvicide, and pools are being stocked with minnows to feed on the mosquito larvae. Reservoir clearing and water-level fluctuation are also important. Mr. Stromquist concludes the symposium with an account of the tactics of this campaign.

These three articles are abstracted from papers presented before the Sanitary Engineering Division on October 17, 1935, at the Birmingham Meeting.

Sewage Treatment Experiments at Atlanta, Ga.

By M. T. SINGLETON, M. AM. SOC. C.E.

WIEDEMAN AND SINGLETON, CONSULTING ENGINEERS, ATLANTA, GA.

and G. R. FRITH

CHEMIST IN CHARGE OF THE EXPERIMENTAL PLANT, ATLANTA, GA.

CONSTRUCTED in 1913, the Intrenchment Creek Disposal Plant at Atlanta, Ga., serves the southwestern part of the city. The plant consists of a battery of 7 Imhoff tanks designed for a flow of 5 mgd with 3-hr detention in the flow chamber, followed by two acres of trickling filters about 6 ft deep. The trickling filter effluent is discharged directly into a small stream; no final settling tanks are provided.

The present average dry-weather flow at the plant is 8 mgd. About three-fourths of the Imhoff tank effluent is treated in the trickling filter and the remainder is bypassed. The sewage flow will soon be increased materially by the construction of a new interceptor diverting the sewage from Sugar Creek Valley to this plant. When this sewer is connected, the flow will be more than twice the designed capacity of the plant.

The sewage is largely from a residential and business district, but some industrial wastes are present, including some caustic liquors and dye wastes from a large textile mill. The pH value usually varies from 6.9 to 7.4, but for two or three hours on certain days, when caustic wastes of high concentration are discharged from the textile mill, the pH is raised appreciably and may be 9.0 or higher. These effects are usually smoothed out through the plant and only on rare occasions is the quantity of such waste sufficient to raise the pH of the Imhoff tank effluent above 8.4.

Until recently no analytical work had been done in connection with the operation of the old plant for many years. The plant was put under laboratory control this spring and an experimental plant of 500,000 gal per day capacity put in operation. The purpose of the test was primarily to determine the efficiency of the trickling filter under existing conditions, and the possible economy of using chemical precipitation ahead of the trickling filter to remove a greater part of the suspended solids and B.O.D. before application to the filters.

In the experimental plant, provision was made to take either raw or settled sewage from the Imhoff tank channels over a measuring weir (Fig. 1). The rate of flow through the test plant was maintained constant at 1/2 mgd. Ferrous sulfate ($FeSO_4.7H_2O$) was fed by a standard dry-feed machine and chlorinated in the solution line before being applied to the sewage. After a flash mix

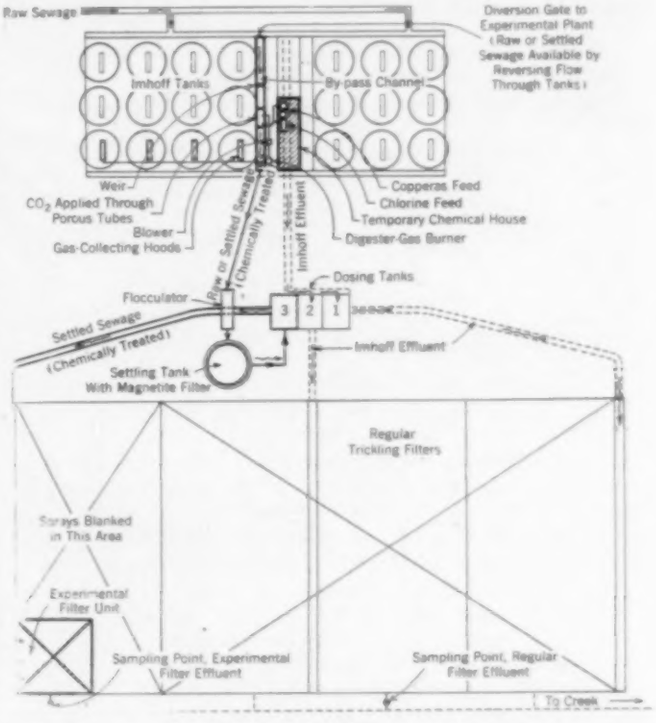

FIG. 1. GENERAL LAYOUT OF INTRENCHMENT CREEK SEWAGE DISPOSAL PLANT

Equipment Used in Experimental Work Is Indicated by Heavy Lines

of 2 min, the sewage was passed through a standard Dorr flocculator with 30-min detention and then through a settling tank with 1.45-hr detention. The settling tank was equipped with mechanical sludge scrapers and a magnetite filter. The chemically treated effluent was then applied to a part of the filter blocked off from the main filter so that separate effluent samples could be taken. Parallel samples were taken from the test plant and the old plant.

A CORNER OF THE INTRENCHMENT CREEK DISPOSAL PLANT
Dosing Chambers in Foreground; Experimental Clarifier and Flocculator to the Right

CONDITIONS AT THE OLD PLANT

The operation of the present plant in its overloaded condition is handicapped by constant foaming of the gas vents of the Imhoff tanks. Digestion-tank and drying-bed capacities are entirely inadequate, and undoubtedly the caustic waste in the sewage at times impairs the efficiency of the trickling filter. Distribution on the old filter is very poor most of the time because of constant clogging of the nozzles. In spite of these difficulties the plant provides a fair degree of purification for that part of the sewage that is treated on the filter.

TABLE I. EFFLUENT CHARACTERISTICS, INTRENCHMENT CREEK DISPOSAL PLANT

Trickling Filter Operating at 2 Mgd per Acre; No Chemical Treatment

ITEM	RAW SEWAGE	IMHOFF EFFLUENT	PER CENT RED.	FILTER EFFLUENT	TOTAL PER CENT RED.	STRAINED SAMPLES	TOTAL PER CENT RED.
	Ppm	Ppm		Ppm		Ppm	
(*a*) 24-hour composite of half-hour samples							
Suspended solids	180	70	63	40	78	16	91
5-Day B.O.D.	170	120	30	30	82	18	89
(*b*) 8-hour composite of half-hour samples (peak-flow period)							
Suspended solids	300	80	73	50	83	20	93
5-day B.O.D.	280	175	37	60	80	36	87

Table I(*a*) indicates typical average operating results of the old plant based on 24-hr composites of $^1/_2$-hr samples weighted approximately with the flow. During this time the part of the trickling filter from which these samples were taken was operated at about 2 mgd per acre and excess flow was by-passed. The results given in this table include the night flows; conditions during the peak day loads are indicated in Table I(*b*). Part of the trickling filter effluent was strained through a small laboratory magnetite filter ($2^1/_2$ in. sand) at 3 gal per sq ft per min, and samples of the filtrate were analyzed with the plant samples. Table I(*b*) gives similar data for the effluent during the hours of peak load.

Sewage is now being applied to a part of the filter at the rate of approximately 4 mgd per acre without chemicals. This operation has not yet continued long enough to determine results with certainty, but the determinations that have been made indicate that the B.O.D. of the filter effluent averages about 70 ppm.

SHOULD CHEMICALS BE APPLIED TO IMHOFF EFFLUENT OR TO RAW SEWAGE?

Operation of the experimental plant was begun in June of this year and is still in progress. The chemical dose has been varied from 200 lb of chlorinated copperas per million gallons of sewage to as high as 600 lb. The trickling filter rate has been varied from 4 to 6 mgd per acre.

In the early months of operation, chemicals were applied to the Imhoff tank effluent. It will be noted from Table I that a fairly high removal of suspended solids was effected by the Imhoff tanks. When chlorinated copperas was applied to the Imhoff effluent, the sewage took on a distinct brown iron color and there was a definite time lag before floc formed. The floc was extremely fine and settled very slowly.

During the time the plant was operating on Imhoff tank effluent, a series of jar tests was made to compare the effectiveness of chemicals on raw and settled sewage. These tests did not indicate any saving in chemicals by presedimentation; in fact a given chemical dose always produced lower turbidities in the raw than in the settled sewage, or equal turbidities could be obtained by a smaller chemical dose in the raw sewage. The floc formed more quickly and settled rapidly.

The unquestionably better results obtained by the application of chemicals to the raw sewage led to the abandonment of presedimentation, and the experimental plant was changed to operate on raw sewage instead of Imhoff effluent.

It was soon determined that reasonable doses of chlorinated copperas (400 to 500 lb per million gal) would not affect the anticipated degree of clarification. For a while lime was fed with the copperas for pH adjustment, but its use was abandoned because it was feared that the high pH would be detrimental to the trickling filter and because during periods when textile mill wastes were present good flocculation was not obtained with lime.

ADJUSTING THE PH WITH CARBON DIOXIDE

Acid pH adjustment was tried with good results, but appeared to be undesirable because of the cost and the difficulty of handling the sulfuric acid. It is possible that this treatment would eventually cause corrosion troubles and also might affect the trickling filter adversely.

In the search for some means of improving results by pH adjustment, it was decided to try carbon dioxide gas. Numerous laboratory tests, using pure CO_2, indicated that a marked improvement in clarification could be

obtained by its use. On this sewage, a free CO_2 content of 100 to 150 ppm reduced the pH to 6.2, except when the initial alkalinity was unusually high. The sewage absorbed the CO_2 very readily. While it may not be practicable to reduce the pH with CO_2 to the optimum of 5.4 for Atlanta sewage, the improvement that could be effected by reasonable quantities of gas was of real importance.

TABLE II. EFFLUENT CHARACTERISTICS, EXPERIMENTAL PLANT

Trickling Filter Operating at 6 Mgd per Acre on Imhoff Tank Effluent; Chemical Dosage, 400 Lb $FeSO_4.7H_2O$, Chlorinated, per Million Gallons

ITEM	RAW SEWAGE	IMHOFF EFFLUENT	AFTER CHEMICALIZATION	PER CENT RED.	FILTER EFFLUENT	TOTAL PER CENT RED.
	Ppm	Ppm	Ppm		Ppm	
Suspended Solids .	175	80	85	52	40	78
5-day B.O.D. . . .	165	120	105	35	28	83

Equipment was installed for collecting and burning the gas from the Imhoff tank vents, and the flue gases from the burner were introduced into the sewage by means of a small blower connected to porous tubes submerged in a pit in the channel leading sewage to the experimental plant. While this method of application of CO_2 was inefficient, because of the shallow submergence of the tubes and the poor combustion in the home-made burner, the pH was maintained generally between 6.4 and 6.8 regardless of the pH of the raw sewage, which varied from 6.9 to 8.4. Flue gas from the burner had a CO_2 content of from 4 to 6 per cent and the quantity of digester gas burned was approximately 3 cu ft per min, which was applied to a sewage flow of $^1/_2$ mgd. Further work is being done to develop more efficient means of combustion and application of the gas.

During the first months of the tests most thought was given to means of increasing the clarification, the thought being that the ultimate results would depend upon the degree of treatment ahead of the trickling filter. It was found that the B.O.D. and suspended solids of the experimental clarifier effluent were very little better than those of the Imhoff effluent, which had not been treated with chemicals. It appeared that the doses necessary to produce the anticipated degree of clarification would be excessive—probably 700 to 900 lb of copperas per million gallons.

CHEMICAL TREATMENT PERMITTED HIGHER FILTERING RATES

It soon became obvious that the experimental trickling filter to which chemically treated sewage was applied was producing good results regardless of the chemical dose. With rates as high as 6 mgd per acre, the effluent was as satisfactory as that from the old filter operating at 2 mgd per acre. This seemed to hold true regardless of how much clarification was effected ahead of the filter, and it seemed that the benefit from the iron dose was obtained mainly in this last stage of treatment.

Table II gives results of a typical week's operation using 400 lb of chlorinated copperas per million gallons at a trickling filter rate of 6 mgd per acre. Variation of the chemical dose did not materially affect the results.

In these tests chemicals were applied to the Imhoff tank effluent. There was a slight increase in suspended solids after settling and some decrease in B.O.D. The sludge removed from the settling tank was about equivalent to the chemicals added.

These results are based on average 24-hr composite samples for the week. A better picture of what takes place during the peak day flows may be seen from the results of the series of 4-hr B.O.D. composites given in Table III.

Results in Table II compared with Table I(*a*) indicate that the experimental filter at the high rate was producing about the same results as the old filter operating on the normal rate, based on 24-hr composites. However, from results in Table III, it is seen that the B.O.D. of the experimental effluent during the peak day flows was appreciably better than results from the regular filter during the same period. The experimental filter was run at a constant rate of 6 mgd per acre while the regular filter rate varied with the flow from less than 1 mgd per acre in the early morning hours to approximately 3 mgd per acre around 11:00 a.m.

After these tests, chemical application was discontinued during the night flows and about 300 lb of copperas was applied at a constant rate for 16 hr of the day. The results over a period of two weeks were practically the same as those given in Table III.

Since the smaller doses seemed to be as effective as the larger, and since most of the benefit from the treatment took place in the trickling filter, the chemical feed was discontinued for a week and untreated settled sewage applied to the iron-impregnated filter. The results compared favorably with the preceding week, but with a rising trend in the B.O.D. of the effluent toward the end of the week.

EXCESSIVE COPPERAS DOSES WERE TOXIC TO THE FILTER

The setup of the test plant was then changed to by-pass the flocculator and clarifier. Chemicals were applied to Imhoff effluent which was applied directly to the experimental filter at the rate of 6 mgd per acre. During the first week of this method of operation, approximately 300 lb of chlorinated copperas per million gallons was used. By the middle of the week there was no apparent film left on the filter and the B.O.D. of the effluent rose to approximately 125, accompanied by a high turbidity and colloidal iron color. Undoubtedly during this operation the iron applied to the filter was much greater than had been carried over previously from the clarifier in the colloidal state. The damage to the filter cannot be attributed to excess chlorine as no residual was present. Apparently the high iron dose was toxic to the filter. After a week of such operation, the chemical feed was stopped and untreated Imhoff effluent was applied to the experimental filter for a week. On the second day a good film had re-formed in the filter and the turbidity of the effluent had dropped to normal.

The tests are being continued, and work is now being done to determine what effect very small doses of iron

INTRODUCING CARBON DIOXIDE INTO SEWAGE
Flue Gas from the Burner in the Background Is Forced by the Blower Into Porous Tubes Underlying the Channel

will have when applied direct to the filter with and without oxidation by chlorine. This phase of the work has not progressed far enough for results to be reported.

It is interesting to note that some thirty years ago Dunbar (*Principles of Sewage Treatment* by Dr. W. P. Dunbar and H. T. Calvert) in experimenting with closed contact beds in Germany, found that by adding iron to the beds in the form of nails a greater reduction in "oxygen absorbed" was obtained—59 per cent as against 48.5 per cent—and that, of the available oxygen present in the bed, 91.8 per cent was used up as against 32.4 per cent in the bed without nails.

GENERAL OBSERVATIONS

As a result of the experiments to date, the following observations can be made:

1. In the use of chemical precipitation of sewage at the Intrenchment Creek Plant by use of chlorinated copperas, presedimentation does not effect a saving in chemicals and it is indicated that chemical treatment of the settled sewage would be more costly and less satisfactory than treatment of raw sewage.
2. Adjustment of the pH to the acid side of neutrality is more effective on this sewage than the use of lime.
3. The use of CO_2 is a practical means of pH adjustment, facilitating flocculation and reducing expenditures for chemicals.
4. The improved operation of the trickling filter is apparently not wholly dependent upon the degree of purification effected by chemical precipitation.
5. Small doses of iron apparently condition the sewage by a change in the character of the colloidal matter, in such a way that it is more amenable to treatment by the filter, and also the presence of iron on the filter stone or in the bacterial filter seems to promote better purification.
6. Laboratory tests indicate that a filter or strainer in conjunction with final clarifiers would serve a good purpose either with or without chemical precipitation of the final effluent.

Since this article was written, further tests have proved that no real benefit is obtained by the application of copperas to the sewage ahead of the filters without oxidation with chlorine.

TABLE III. FIVE-DAY B.O.D. OF PLANT EFFLUENTS, IN PARTS PER MILLION

4-HR PERIOD	RAW SEWAGE	CLARIFIER EFFLUENT	FILTER EFFLUENT
Experimental plant, operated as in Table II			
8 a.m. to 12 m.	260	112	22
12 m. to 4 p.m.	230	125	20
4 p.m. to 8 p.m.	190	122	25
8 p.m. to 12 p.m.	185	140	27
12 p.m. to 4 a.m.	150	114	35
4 a.m. to 8 a.m.	60	62	31
Regular plant, operated as in Table I			
8 a.m. to 12 m.	260	130	50
12 m. to 4 p.m.	230	144	51
4 p.m. to 8 p.m.	190	125	43
8 p.m. to 12 p.m.	185	145	18*
12 p.m. to 4 a.m.	150	118	24
4 a.m. to 8 a.m.	60	65	16

*This result appears somewhat out of line.

NOTE: B.O.D. determinations were made on the unsettled effluent of the trickling filter. A further reduction of approximately 40 per cent in the residual B.O.D. and 60 per cent in residual suspended solids was obtained by filtering the trickling filter effluent through 2½ in. of magnetite sand in the laboratory filter.

Chemical Precipitation Plant at Birmingham

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THE Shades Valley sewage treatment plant at Birmingham, Ala., is of the chemical precipitation type, with a capacity of 2 mgd for complete chemical treatment, and 4 mgd for primary treatment, using chlorinated copperas as the coagulant. It has been in operation since the summer of 1934. A brief statement of the reasons for selecting chemical precipitation may be of interest.

1. The receiving stream has a wide variation of flow, being high in the wet, cold season, and low in the hot, dry season, and is used extensively for recreational purposes during the summer. Therefore complete treatment is required during the summer months, while primary treatment is sufficient during the winter months. This is best accomplished by a chemical precipitation plant, as it can be changed from primary to more complete treatment simply by adding chemicals.
2. The tributary drainage area is a rapidly growing, high-class residential section. With a biological type of plant, this rapidly increasing population load would require an excessively large initial expenditure, or the continuous addition of small units, while with a chemical plant the increasing strength and volume of sewage is met by varying the chemical dosage.
3. The cost of treatment of sewage by a chemical process is considerably less than by any other type of treatment giving comparable results. At the Shades Valley plant the cost is slightly more than the operating cost of primary treatment plus the cost of chemicals added.
4. The relatively weak sewage from this drainage area would require large units out of proportion to the amount of organic matter removed in a biological plant.
5. The collecting system is installed for an ultimate

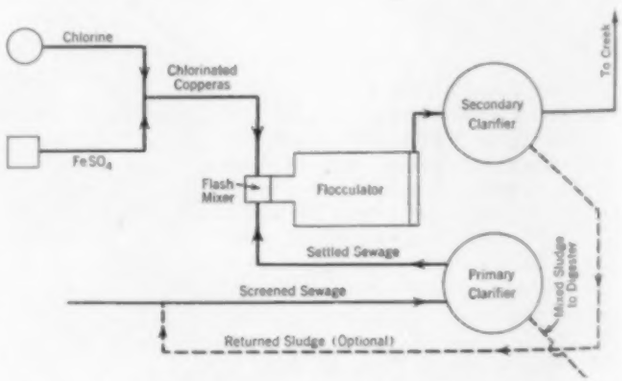

FIG. 1. SERIES OPERATION OF THE SHADES VALLEY PLANT

At Times of Peak Load, Screened Sewage Is Passed Directly to the Flash Mixer and the Clarifiers Are Operated in Parallel

population of 100,000, while the present connected load is only a small fraction of this; therefore the infiltration is relatively high, requiring a plant that is flexible enough to meet the sudden variation in character and volume of sewage received. The rate of flow of the sewage arriving at the plant increases from 1,000,000 gal per day to 5,000,000 gal per day in less than two hours immediately following a rain. This is usually met by changing the plant from series to parallel operation and increasing the amount of coagulant added.

6. The hourly dry-weather variation in the strength and volume of the sewage covers such a wide range that chemical precipitation seems to be the most economical way to meet this condition. The rate at which the coagulant is added is changed six times daily, the maximum rate during the afternoon hours being from three to six times the minimum rate in the early morning hours.

7. The outfall sewer coming into the plant is a 48-in. diameter conduit with a slope of 0.0008. Due to the low velocity caused by this flat slope, solids are deposited in this sewer during minimum flows and flushed down to the plant with the first rain. This sudden load of stale septic sewage would seriously interfere with the operation of a biological process.

8. The installation cost of this plant was considerably less than that for a biological type of plant.

9. The general compactness, neat appearance, absence of odors and fly breeding, are desirable features obtained in this installation.

The plant consists of a flash mixer, flocculator, two settling tanks, a two-stage digestion system, and open sludge-drying beds. The units are so arranged that two basic schemes of operation can be used. In series operation the sewage flows first through one settling tank for preliminary sedimentation, and then through the mixer, flocculator, and final settling tank (Fig. 1). In the other scheme, parallel operation, the sewage flows first into the flash mixer and then through the flocculator, from which one-half goes to each settling tank. Chemical sludge, or mixed sludge, can be returned to the raw sewage in either scheme. Chlorine can be added to either the raw or settled sewage. For primary treatment only, the mixer and flocculator are simply by-passed.

Ferrous sulfate is added by a dry-feed machine. The discharge line from this machine joins that from the chlorinator about 40 ft from the point of application at the flash mixer. A slight excess of chlorine is added at all times for sterilization and as a factor of safety against incomplete oxidation of the ferrous iron.

A COMPACTLY-ARRANGED CHEMICAL TREATMENT SEWAGE PLANT
In the Foreground Is the Sewage Meter. Beyond It Are the Mixer and Flocculator, Twin Clarifiers, a Garage, and the Sludge Drying Beds

On June 1, 1935, chemical operation was started for the current year and has been continuous to date. The average operating results for this period show a 93 per cent reduction in suspended solids and an 85 per cent reduction in B.O.D.

The condition of the receiving stream has been materially improved, and the general results obtained at this installation have justified the selection of the chemical treatment process.

Malaria Control in the Tennessee Valley

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MALARIA control must be considered in the design, construction, and operation of any dams that create artificial ponds or lakes in a malarious region.

The areas of endemic malaria in the Tennessee Valley are mainly along the major streams, where from moderate to high malaria rates prevail from below Chattanooga to the mouth of the river. As the river is developed for navigation, flood control, and the incidental production of power by the construction of dams, the resulting pools will produce a public health hazard if adequate malaria control measures are not provided for and maintained. This is a major problem of the Tennessee Valley Authority, and one which few engineers fully appreciate as an important factor in such developments in this section of the United States. The dams now under construction—Norris, Wheeler, and Pickwick Landing—will create reservoirs which, in addition to Wilson Reservoir, will have a total shore line of over 2,300 miles, of which 1,600 miles is in an area in which malaria is endemic.

Undoubtedly malaria would have received more attention if it were a more dramatic disease, but because its mortality rate is low, it is often looked upon by the individual or the community simply as an affliction that must be endured. Although the transmission of malaria by the Anopheles mosquito had been proved by Sir Ronald Ross in 1898 and striking demonstrations of malaria control had been made under the direction of Gen. W. C. Gorgas in Panama a short time later, only sporadic attempts at control were made in this country prior to 1910.

About that time the U. S. Public Health Service did the first real work with its studies on the distribution and transmission of malaria, prevalence and habits of mosquitoes, and relation of impounded waters to malaria, and began its epic demonstrations of community malaria control at Roanoke Rapids, N.C., Electric Mills, Miss., and Crossett, Ark. Cooperation of state and county

departments of health was gradually enlisted, and by 1922 community demonstrations in Alabama had proved that a fairly dense population group can free itself of malaria at a reasonable cost—that mosquito control is less expensive than the previous cost of doctors' bills, medicine, and lost time, and that once the population is free of malaria the production of industrial plants is increased without additional men or equipment.

In speaking of the early work, it is only fitting that tribute be paid to the group to which we refer with admiration and affection as "the old malaria gang of the Public Health Service"—Drs. H. R. Carter, R. H. VonEzdorf, R. C. Derivaux, and T. H. D. Griffitts, and

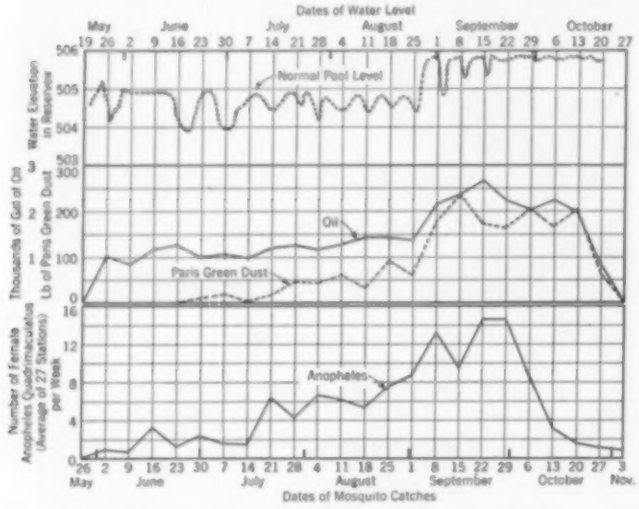


FIG. 1. INFLUENCE OF WATER LEVEL FLUCTUATION ON ANOPHELES PRODUCTION AT WILSON RESERVOIR, 1934

Mr. J. A. LePrince. With limited resources they made studies which are of great scientific value, and laid the foundation upon which have been built our efforts to eliminate malaria. Their contribution, however, is not alone in scientific achievement, but even more in the interest and enthusiasm with which they inspired all who came in contact with them in their work. This influence is still felt and will continue through future generations.

THREE METHODS OF ATTACK

The fact that there is a transmitting agent—the Anopheles mosquito—which forms the connecting link between the sick and the well person, makes possible three lines of attack against malaria—reduction of foci of infection by treating the infected person; elimination of Anopheles mosquitoes by destroying their breeding places by drainage or killing the larvae with oil, Paris green, or other larvicides; and protection of the well person from infected mosquitoes by adequate screening.

The beginning of our knowledge of the influence of impounded waters on the incidence of malaria were studies undertaken by Dr. H. R. Carter and his associates in 1913. The first studies were made on the pond at Blewett's Falls, N.C., at Lock 12 on the Coosa River, and Lock 17 on the Warrior River in Alabama. Following the construction of a hydro-electric plant in Alabama, a great number of suits were filed against the company by nearby residents, claiming infection by malaria as a result of the creation of the lake. The court testimony showed that little was known of the problem at that time, but from 1915 to 1925 studies were made of a number of reservoirs in several states by the Public Health Service, which formed the basis for present state regulations governing impoundage of water. Regulations were offered as early as 1915, and in 1921 Dr. T. H. D. Griffitts drafted suggested regulations for the Federal Power Commission. The first state regulations were adopted by Alabama and Virginia in 1922.

The early work on this problem pointed definitely to Anopheles quadrimaculatus as the principal carrier of malaria in the southeastern part of the country. This species breeds in ponded water, small ponds, or in the shallow areas of artificial lakes, whereas Anopheles punctipennis prefers running and especially spring-fed streams, and Anopheles crucians is usually associated with swamp water of relatively low pH value. This difference in breeding places and the knowledge that the two latter species are not important carriers of malaria have made possible many economies in malaria-control operations, since certain types of breeding places can safely be ignored except where complete mosquito control is the object.

The control of Anopheles mosquitoes must be considered in the design and construction of dams and reserviors as well as in their operation. Conditions favorable to Anopheles are constant water level; accumulations of fine flotage or debris, and aquatic or semi-aquatic vegetation which offers protection to the larvae; minimum wave action; and absence of natural enemies of mosquito larvae. The breeding occurs in shallow water along the shore, especially in the upper ends of inlets or tributaries of a reservior, and is most extensive during the first few years after construction, before a biological balance is established.

Proper preparation of the basin is fundamental and includes the following: (1) Clearing, to provide a clean water surface and clean shore line; (2) draining of those areas that would otherwise retain water as the reservoir is drawn down; and (3) stocking with top-feeding minnows. The state health department regulations governing the maintenance of a project following impoundage are directed primarily at biological control, which is not always practicable and which must be supplemented by the use of larvicides. Considerable latitude in methods is permitted.

The design of the dam must be such as to provide for adequate seasonal and periodic fluctuation of water level. By seasonal fluctuation is meant maintaining the water at the maximum normal level during the winter and spring, and lowering it to normal level at the beginning of the mosquito breeding season. This inhibits the growth of vegetation, and when the water is lowered flotage will be stranded, leaving a clean shore line. Periodic fluctuation is the lowering of the water below the normal level at weekly or 10-day intervals during the mosquito breeding season—July, August, and September, and in some years May and October. This fluctuation tends to discourage the rank growth of aquatic vegetation, and Anopheles larvae are stranded and die or are carried into open water where they are better exposed to their natural enemies. With fluctuation, the need for using larvicides is reduced, and in some cases may even be eliminated. Without fluctuation, control by larvicides is extremely expensive or even impossible.

The construction schedule must be so planned that water is not impounded during the mosquito breeding months, for with the water rising slowly through uncleared areas there will be excessive production of mosquitoes despite heavy applications of larvicides, as was demonstrated on Lake Martin and Lake Wilson in Alabama. The best time for impounding is in the fall

or winter, so that there will be time for flotage to collect and become stranded on the shore before the breeding season begins.

PROVISIONS FOR MALARIA CONTROL AT TVA DAMS

At Norris Dam the normal pool elevation will be 1,020 ft above mean sea level. Since this reservoir will be drawn down during the mosquito breeding season, it is anticipated that extensive application of larvicides will be unnecessary.

The Wheeler Dam originally provided for a normal pool level at 555 ft above mean sea level. The design was modified by increasing the height of the gates to provide a maximum normal level of 556 ft so that a seasonal fluctuation of 1 ft can be obtained. It is proposed to maintain the higher level in the spring, lower the water to El. 555 early in June, and fluctuate it below that level at weekly intervals during the mosquito breeding season. A similar provision is being made in the Pickwick Landing reservoir.

In clearing the area to be inundated so that effective mosquito control can be maintained, it is necessary to remove all trees, undergrowth, logs, and such that may create or collect flotage between the maximum and minimum pool levels, to cut all trees and brush which would penetrate the surface and collect flotage at low water, and to remove vegetation along the shore line.

At Norris the maximum drawdown will be 58 ft. All trees, brush, and logs between the 1,020 and 940-ft contours were cut and either burned or removed from the area, and all trees below El. 940 that would protrude above the water at maximum drawdown were cut and wired down. No marginal clearing has been done above the 1,020-ft contour, for it appears that unnecessary work and expense may be avoided by waiting until the reservoir is filled and then limiting the clearing to those areas that are definitely sources of trouble.

In the Wheeler Reservoir the entire area below the 556-ft contour is being completely cleared, and all brush and logs, except those used for lumber, are burned. From the standpoint of malaria control alone, trees and underbrush that would not protrude at low water could have been left uncut, and felled trees could have been tied down, but since this is a relatively shallow pool such obstructions would be a constant menace to navigation.

The clearing of the Wheeler and Norris Reservoir areas has furnished employment to a maximum of 3,600 men in the Wheeler, and 1,000 in the Norris Reservoir. More than 8,000,000 feet board measure of lumber have been salvaged at Wheeler, and more than 4,000,000 at Norris.

For intelligent planning and operation of malaria control measures, it is essential to know the distribution of the population and the prevalence and distribution of malaria in the area affected. It is also important to determine the malaria incidence before, and from time to time after, impoundage so that the effect of impoundage and the effectiveness of control can be measured. The population affected is that living within one mile of the reservoir, the approximate flight range of the malaria-carrying mosquito.

In the fall of 1934 malaria surveys were made in the one-mile zones surrounding the Wilson Reservoir and the proposed Wheeler Reservoir. In the Wilson Survey, 1,693 blood smears were taken, of which 8.2 per cent were positive. These smears, however, were taken mostly from persons giving a positive history of malaria rather than from a representative sample of the population.

In the Wheeler Reservoir area, a census was taken of all families living in the area to be flooded as well as in the one-mile zone outside the future reservoir, and the data collected included length of residence, ownership, mosquito proofing of the home, age, sex, color, and malaria history of each member of the family. In order to obtain a malaria index, an effort was made to take blood smears of all members of every fifth family; 60 per cent of these, giving a 12 per cent sample of the entire population, were secured. In the rural areas 2,967

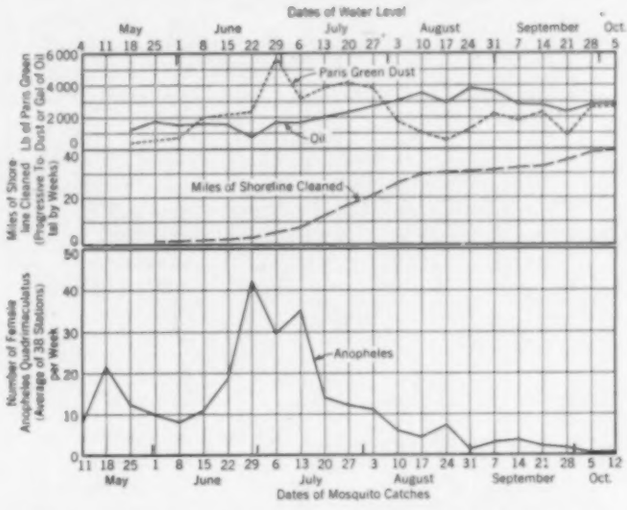


FIG. 2. INFLUENCE OF ANTI-LARVAL OPERATIONS ON ANOPHELES PRODUCTION AT WILSON RESERVOIR, 1935
Water Level Held Constant

blood smears were taken, of which 27 per cent were positive. The rate varied from 19 per cent in Lauderdale to 60 per cent in Lawrence County. Of the positive specimens, 67 per cent were estivo-autumnal, the more severe type. These are high rates, with an unusually high proportion of estivo-autumnal malaria. In Decatur 734 specimens were taken with 9.0 per cent positive, and in Guntersville 7.3 per cent of 55 blood smears were positive. The total population within the one-mile zone is approximately 38,400, of which 24,400 is rural.

The larvicide treatment that has been employed on the Wilson Reservoir, and recently begun on the temporary impoundage in the Norris Reservoir, consists of applying oil or Paris green dust by mechanical equipment mounted in motor boats or, in areas not accessible by boats, by manually operated sprayers and dusters.

When the new reservoirs with their great expanse of shore line are filled, more rapid methods of applying larvicides will be necessary. Especially in the Wheeler Reservoir there will be large shallow areas, favorable for aquatic growths, where stumps left by the clearing will interfere with the operation of boats. Such areas will be difficult to control by the present methods. Experiments have been made with dusting Paris green from airplanes, a method which has been used effectively in dusting cotton to control the boll weevil and in other insect control work in which it is necessary to dust large areas. This method has not been used commercially on impounded reservoirs where the problem is that of dusting a comparatively narrow strip along an irregular shore line. Preliminary flights were made late in the summer of 1934, and the experiments have been continued during the present summer. Data have been collected on the distribution of dust and its effectiveness in killing larvae, together with detailed cost records.

Definite conclusions as to relative cost and effectiveness compared with other methods cannot be made at this time.

Since aquatic and semi-aquatic vegetation offers an environment suitable for mosquito production and an obstacle to economic and effective control through the use of larvicides, the elimination or control of such growth is obviously necessary. A well-trained biologist is working on this problem with a view to developing effective, practical, and economical methods of controlling such vegetation.

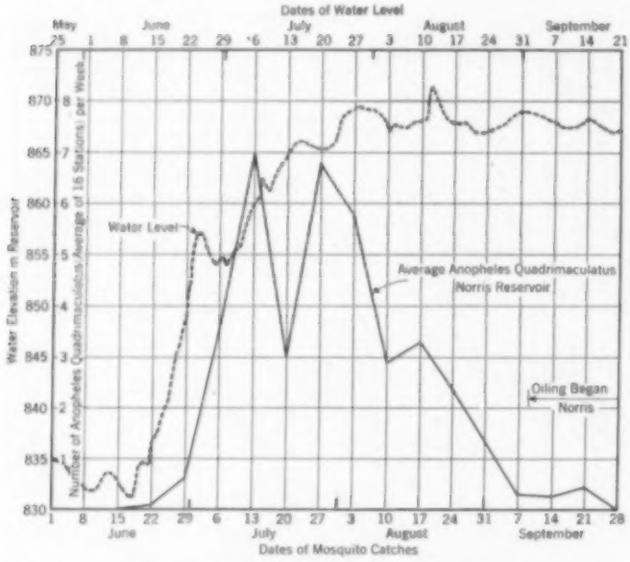


FIG. 3. INFLUENCE OF WATER-LEVEL FLUCTUATION ON ANOPHELES CONTROL AT NORRIS RESERVOIR, 1935

EXPERIENCE WITH WATER-LEVEL FLUCTUATION

To emphasize the value of water-level fluctuation in the control of Anopheles on impounded waters, the experience on the Wilson and Norris reservoirs in 1934 and 1935 will be cited, and illustrated in Figs. 1, 2, and 3, which show the relation between mosquito production, water level, and the amount of larvicides used.

In order to check the effectiveness of the Anopheles control work, a series of "catching stations" is established around the reservoir. The Anopheles quadrimaculatus rests during the day, preferably in a dark, sheltered building occupied by human beings or animals so that the blood meal will be easily available. Weekly inspections are made of these catching stations, and the mosquitoes found are caught and identified. In these charts the dates referring to the number of mosquitoes are moved forward one week as compared with the curve showing water level or larvicides used because the effect of such measures is noted about one week later.

On the Wilson reservoir in 1934 effective control was maintained with a fluctuation of 1 ft at 10-day intervals, as shown in Fig. 1. When the fluctuation was reduced to only 6 in. on July 9 an increased production was observed and following the raising of the pool to the maximum level on August 28, still greater production resulted in spite of increased efforts and the use of more than double the quantity of larvicides. The decline after October 1 is the usual fall decrease in mosquito production.

In Fig. 2 it is shown that with constant water level during the summer of 1935 effective control was not established until vegetation was removed from thirty miles of shore line to make possible effective application of larvicides. Here the lack of fluctuation more than doubled the cost of malaria control during the season, due to additional larvicidal work and marginal clearing.

A thorough mosquito survey was made in the Norris area in 1934 and not a single specimen of Anopheles quadrimaculatus was found, due to the absence of the type of breeding place favored by this species. During the summer of 1935 the water was raised about 50 ft upstream from Norris Dam, and about the middle of June this species began to appear around the pool so formed, the observations being shown in Fig. 3. Sixteen catching stations were established around the temporary impoundage, but some of these were demolished in the course of the general exodus from the area to be flooded. The solid line shows the average number found per station per week in these stations, all undoubtedly originating in the pool. The production increased until closure of the dam reached the point where the water level could be controlled by the sluice gates, after which periodic fluctuation was maintained, resulting in a rapid and continuous decline in the production of Anopheles mosquitos. The reduction shown for the week of July 20 was probably due to the removal of a station where a large catch was made the previous week. At the same time Anopheles production increased in a slowly filling independent pool created by a small dam in one arm of the reservoir as part of a recreational area known as Big Ridge Park.

These charts furnish irrefutable evidence of the value of fluctuation in malaria control on impounded waters.

WILL THIS CONTROL INTERFERE WITH POWER?

But even with proper design and construction, can fluctuation be maintained without serious loss of head and efficiency in the operation of reservoirs for the production of power? To determine this the Engineering Planning Section has made a series of studies—the first ever made before the construction of a series of dams to plan a synchronized operation of reservoirs which will permit fluctuation for malaria control.

Using an estimated typical weekly load curve with an assumed full development of possible power potentialities, and a condition of extremely low flow, it was found that by transferring the load from one dam to another, so that the reservoirs were alternately raised and lowered, adequate fluctuation could be maintained without interference with the power output. If this is possible under these extreme conditions, it is certainly possible under normal conditions, especially since during the early years of the project, which are the critical years for malaria control, the actual power demand will be less than that assumed in the study. It should be noted that the Authority is under obligation to operate all reservoirs under its control in the manner that will produce optimum results to navigation and flood control. Fluctuation would in no event conflict with such operation.

This outlines some of the malaria problems confronting the Tennessee Valley Authority. To insure the development of the malaria control program on a sound and sane basis, a Malaria Advisory Board has been established. The members of this board are Dr. L. L. Williams, Jr., Dr. T. H. D. Griffitts, and J. A. LePrince, of the U. S. Public Health Service; Dr. W. V. King, of the U. S. Bureau of Entomology; and Dr. Mark F. Boyd, of the Rockefeller Foundation, all recognized not only in this country but abroad as authorities on malaria and its control. The value of the advice and assistance of these men, based upon their wide experience, cannot be overestimated.

Construction of the New Orleans Bridge

Sand-Island Method of Sinking Caissons Proves Valuable at Mississippi Crossing

By HARRY J. ENGEL

JUNIOR AMERICAN SOCIETY OF CIVIL ENGINEERS

ASSISTANT ENGINEER, MODJESKI, MASTERS AND CASE, INC., PHILADELPHIA, PA.

SCHEDULED for opening during the present month, the cantilever bridge at New Orleans is a notable addition to the series of major crossings of the Mississippi which was begun in the 1870's with the construction of the Eads Bridge at St. Louis. This latest crossing, with an over-all length of almost $4\frac{1}{2}$ miles, is one of the longest important bridges in the world, and presented, particularly in its foundations, a problem more difficult than was found at any other bridge site on the river. The severe floods which occur at New Orleans in the event of simultaneous high water in two or more of the upper branches of the river, also offer uncommon hazards to construction.

While more than 100 bridges cross the Mississippi from its source in northern Minnesota to the most southerly existing crossing at Vicksburg, the ten existing bridges from St. Louis to Vicksburg and the one now nearing completion at New Orleans are of outstanding importance. These bridges reflect, in their design, not only the advance in construction methods since Captain Eads first bridged the lower river at St. Louis, but also the varying characteristics of the river.

In its upper reaches the Mississippi is a cutting river; in the neighborhood of St. Louis it alternately scours and deposits material; and toward the mouth it builds land from sedimentary deposits. The varying foundation conditions resulting from these characteristics have often influenced the type of design chosen, as instanced in the new Davenport Bridge, where good rock foundations have made possible the use of 3-span continuous trusses and a suspension structure. The triple arched Eads Bridge and succeeding simple span bridges at St. Louis were all founded on rock. The lower limit of rock foundations occurs at Thebes, Ill., and the change from rock to sedimentary foundation material near that point accounts for the prevalence of the cantilever type of long-span construction in the remaining bridges to the Gulf, since this type permits minor settlement of supports without affecting stresses in the members.

FOUNDATION studies made at the site of the New Orleans Bridge disclosed that the soil underlying the river to great depths consisted of alternate layers of sand, silt, and clay, and the piers were accordingly founded in good sand at a depth of 170 ft below Gulf level. As the pressure at this depth would make the use of pneumatic caissons impracticable, it was decided to stabilize open dredged-well caissons by means of the "sand-island" method. By that method (first used on the Suisin Bay Bridge) the concrete caissons were sunk to plan depth inside an artificial island of sand confined within a cylindrical metal ring, with no difficulty from tipping and only a little from blow-ins of unstable material under the cutting edge. The accompanying paper, descriptive of the problem and the ingenious solution applied, is abstracted from a paper written by Mr. Engel and presented by C. Glennon Melville, engineer of construction, on October 17, 1935, before the Structural Division at the Birmingham Meeting. Mr. Engel prepared the sketch reproduced above.

Some idea of the foundation problems at New Orleans may be obtained from the fact that the depth of the river at one of the piers is 75 ft below Gulf level. Since borings disclosed that the river bottom consisted of alternate layers of sand, silt, clay, and mixtures of those materials, all delta deposits, a satisfactory sand foundation was not available until the piers were carried to a depth of 170 ft below gulf level (Fig. 1).

The idea of a railroad crossing or a combined railroad and highway crossing of the Mississippi at New Orleans has been under consideration for the past half century, inspired by the fact that this city has been dependent on expensive and hazardous ferry service to carry traffic of the western railroads into the city. The crossing projects have included low-level movable bridges, tunnels, and high-level structures similar to the bridge now under construction. A bridge was designed for the Southern Pacific Railroad in 1892 and bids were received, but due to a business depression it was never built. Because of the depth of water and other physical conditions, tunnels were judged uneconomical; but the idea of a bridge persisted. This idea

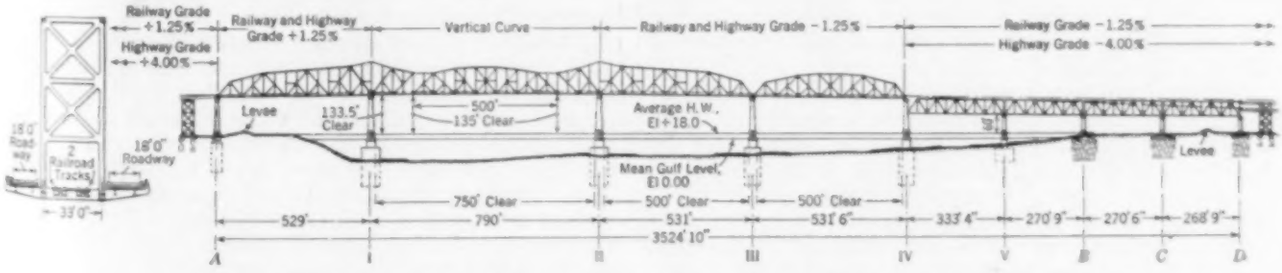


FIG. 1. ELEVATION OF BRIDGE LOOKING UPSTREAM, AND CROSS SECTION OF THROUGH SPANS

was sponsored principally by the Public Belt Railroad, which provides terminal facilities and freight connections for all the railroads entering New Orleans.

In 1924 interest in the project reached such a point that the Public Belt Railroad presented to the War Department, for approval, plans for a low-level bridge containing a vertical-lift span for the passage of large ships. This design was opposed by navigation interests, which contended that it offered an obstruction to shipping, and the plans were later rejected by the War Department. Ralph Modjeski, M. Am. Soc. C.E., was then engaged by the Public Belt Railroad as chief engineer, to consult with the army engineers and to prepare final plans for the structure.

Since the river is intended to be open to deep-water navigation as far upstream as Baton Rouge, and since a fixed bridge was desired at New Orleans, a high-level type of bridge was required. A War Department permit was granted in 1925 for a structure with a 112-ft clearance over mean high water, but the lapse of congressional authority required that a new permit be secured, in which 135 ft was stipulated. The design was changed to incorporate the higher clearance, and the final War Department permit on the revised plans was issued in December 1930. Since high water on the river is 18 ft above Gulf level, the vertical clearance provided amounts to 153 ft above mean Gulf level.

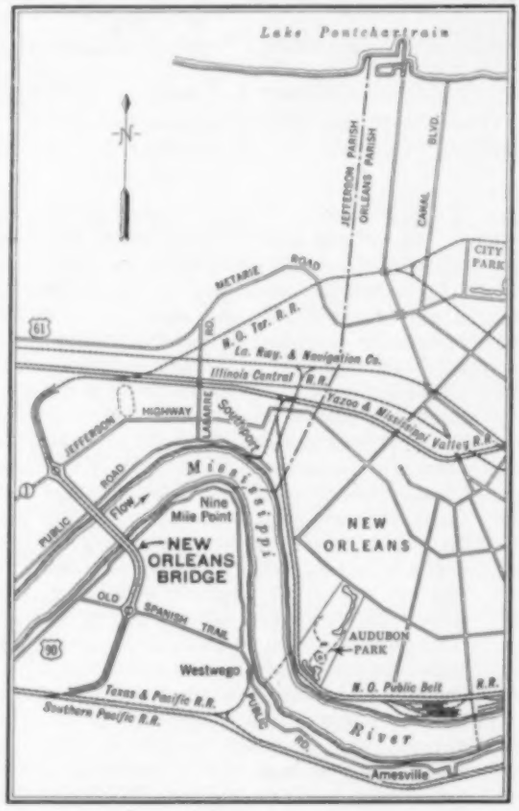


FIG. 2. PLAN OF PART OF NEW ORLEANS, SHOWING LOCATION OF BRIDGE

The choice of a site for the bridge, about 8 miles above the center of the city, was influenced by property values and by ready accessibility to the railroads. The river flows around the city in a general west-to-east direction, and the site chosen is actually to the west of New Orleans. Highway traffic reaches the bridge by way of the Jefferson Highway, a principal traffic artery running up the river on the New Orleans side (Fig. 2).

Two railroad tracks are provided on the structure, and two 18-ft roadways with sidewalks are cantilevered outside the main trusses. On the approaches, the highways descend on a 4 per cent grade. Because of the steeper slope, these reach ground level before the railroad deck. Since the railroad grade permitted is only 1.25 per cent and high water is well above ground level at the bridge end of the approaches, the railroad approaches together with the bridge give a total length of steel structure of 22,995 ft, or almost $4^1/_2$ miles.

The principal cantilever span is 790 ft, as required by the War Department. Each of the anchor arms is 528 ft long, and a 531-ft through-truss span on the New Orleans side of the cantilever is similar in appearance to the suspended span. Four deck spans—one of 330-ft length and three of 267-ft length—complete the main bridge superstructure. The approaches are of the steel-trestle type, on wooden pile foundations.

Designing foundations for the main bridge constituted one of the most interesting features of the work. In view of the absence of any really hard stratum, it was considered necessary to study the underlying materials by means of the soil mechanics methods developed by Charles Terzaghi, M. Am. Soc. C.E. Beginning with the idea of founding the piers in good sand, test borings were taken at intervals, so that representative specimens of the material could be subjected to consolidation tests and thoroughly analyzed to determine the amount of settlement which might be expected in the bulbs of pressure under the piers. This work was done by the firm of Moran and Proctor, who acted as consultants on the foundation work. The studies showed that the piers could be founded at a depth of 170 ft below Gulf level, and that it would be possible to sustain the foundation loads entirely on the pier bases without depending on skin friction.

Accordingly, the piers were proportioned on that basis, and the footings below El. −35 were made cellular to reduce the total load on the bottom as much as possible. This also saved concrete. Once a pier had been sunk to its correct elevation, the bottoms of the wells were sealed and the tops of the interior wells were covered with a distributing block to support the upper pier shafts. The remainder of the wells were covered with a timber deck to prevent them from silting in with river mud after the piers were completed. The cellular base and the upper shafts are of reinforced concrete except for the granite facing which is provided from beneath low-water level to above high water. With this construction, the pier and superstructure loads exert an additional pressure on the sand of only about 3.5 tons per sq ft, without skin friction.

PROPOSED METHODS OF SINKING THE PIERS

As the depth to which the piers were to be carried is below the practicable limit at which men can work under compressed air, the use of open dredged-well caissons was decided upon. These caissons were to be of the conventional type, with hollow timber walls framing the dredging wells, and a metal cutting edge. Reinforced concrete was to be placed in the hollow walls while sinking, the timber walls being calked tight to ensure that the concrete would be placed in the dry.

When bids were called for on these plans, in September 1931, the specifications permitted the contractors to submit alternate designs for the caissons. This was done because the flood currents of the Mississippi and the sedimentary nature of the foundation material led the engineers to believe that there might be trouble with an open caisson of the conventional type, although such a caisson was used as a basis for bidding. Conventional open dredged-well caissons have been known to tip during sinking or after landing on the bottom, due to swift currents or to obstructions in the underground material,

if no stabilizing force is provided except the dead weight of the caissons. The Siems-Helmers Company based its successful bid on the "sand-island" method, which it had used with good results at Suisin Bay.

The engineers had also discussed with the contractors the possibility of using steel caissons arranged for open dredging through watertight wells, so devised that at any time any well could be sealed off with a steel bulkhead and air used to control the sinking and stability of the caisson. The Dravo Contracting Company, the second low bidder, developed this idea and submitted its bid based on the approval of these plans. Thus, in addition to bringing out the sand-island method eventually employed at New Orleans, the bidding introduced the air-control method since used with only slight modification in the domed caissons for the deep foundations of the San Francisco–Oakland Bay Bridge.

ADVANTAGES OF THE SAND-ISLAND METHOD

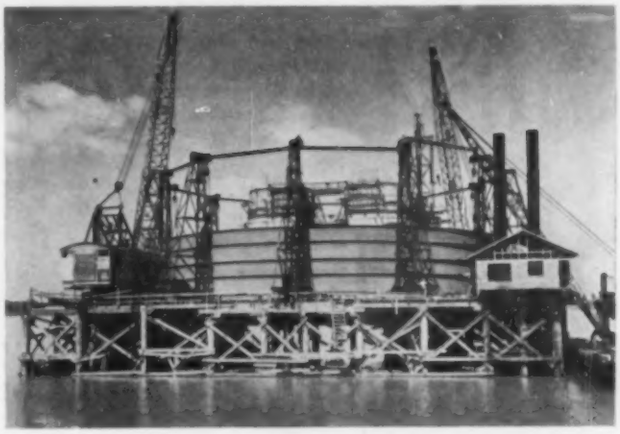
The sand-island method provides continuous control over the stability of the caisson, which is sunk entirely within an artificial island of sand confined by a cylindrical metal ring. In order to tip the caisson it would seem necessary to tip the entire sand island. Actually, experience has shown that in materials like sand and silt there is some possibility of tipping within the island, but the chance of this is slight. In theory, the sand-island method seems to have the following advantages over the conventional manner of sinking open dredged-well caissons:

1. Since the sand island is carried up to an elevation above high water, flood waters cannot interfere with the work. Once the sand island is prepared, work can be carried forward continuously to completion of the pier, resulting in a considerable saving in time.
2. The caisson walls can be built of reinforced concrete throughout, unweakened by the timber used in the conventional caisson.
3. All the concrete in these walls is placed in the dry, and in a place so easily accessible that careful inspection is possible for every lift.
4. Once the sand island is filled, before any concrete has been placed, the river bottom is subjected to its maximum load, reducing the hazard from that point on.

PROCEDURE WITH THE SAND-ISLAND METHOD

New Orleans is only the second place where the modern sand-island method has been used, and, since conditions there are different from, and in many respects more hazardous than, those at Suisin Bay, the foundation work produced results not previously encountered.

Because of the possibility of river scour, woven willow mattresses 250 ft by 450 ft were sunk under the weight of riprap to the river bottom at the beginning of work on each pier. Next, a ring of falsework consisting of timber piles framed into bents was driven around the confines of what was to be the sand island. Within this falsework,



SAND-ISLAND SHELL AT PIER 1

Built Up of 120-Ft Circular Rings 10 Ft in Height, This Shell Confines the Sand Through Which the Concrete Caisson Is Sunk

the erection of the confining shell for the sand island was begun. This shell consisted of circular rings about 120 ft in diameter and 10 ft high, constructed of $^1/_2$-in metal with angle flanges and placed one on top of the other. Three 10-ft sections of the rings were assembled at a time on needle beams spanning the falsework, and were lowered from this position by means of 12-hoist frames set up around the falsework. After three sections were lowered, the shell weight was again transferred to the needle beams and another group assembled above it. Thus the shell was built up gradually, always supported from the top, until it rested on the mattress. Each mattress was then cut through by means of a sharpened steel pile driven around the inside of the ring, and the portion of mattress inside the ring was removed. Sand was then filled into the ring and the concrete caisson built on the island thus formed (Fig. 3).

In building the caisson, first a metal cutting-edge was riveted together on the top of the island in the correct plan position, and removable forms were constructed and reinforcing was placed for the first lift of the concrete caisson walls. Concrete was placed in lifts of from 10 to 15 ft in height. The sand-island fill was then dredged out from the wells. The concrete caisson in each case sank under its own weight during the dredging

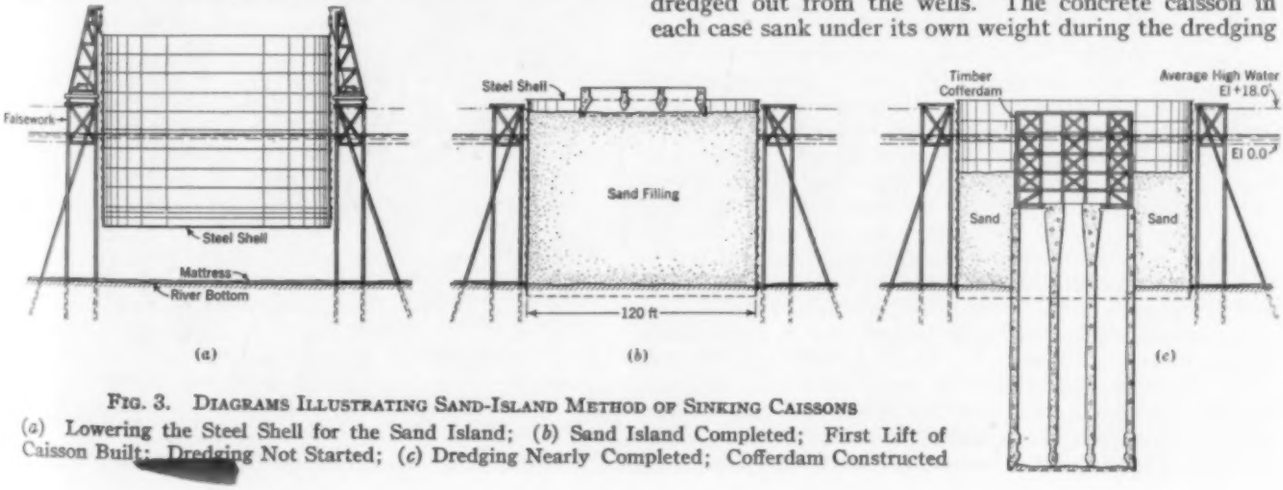


FIG. 3. DIAGRAMS ILLUSTRATING SAND-ISLAND METHOD OF SINKING CAISSONS

(*a*) Lowering the Steel Shell for the Sand Island; (*b*) Sand Island Completed; First Lift of Caisson Built; Dredging Not Started; (*c*) Dredging Nearly Completed; Cofferdam Constructed

until it had reached such a depth as to require another lift. This process continued until the timber cofferdam for the upper shaft could be added and the caisson carried to its planned depth.

The bottoms of the wells were then sealed with concrete

CONCRETE SHAFT OF PIER 3
The Derrick for Construction of the Upper Parts Was Carried on a Steel Tower 100 Ft High, Supported on Barges

placed by tremie. Afterward, the distributing block above the caissons was placed, the sand-island shell removed, and the upper pier shaft constructed (Fig. 4).

PLACING MAIN BRIDGE SUBSTRUCTURE

Foundation work for the main bridge at New Orleans was begun early in 1933, Pier 5 being the first completed. At some of the deeper piers, trouble from blow-ins of the underground material took place, the nature of which can best be described from events in the sinking of Pier 3. On Pier 3, the cutting edge had reached El. −63, 8 ft below the bed of the river, when material flowed into the bottoms of some of the wells from the sand-island fill. The sand and silt river bottom ran very easily, displacing under the imposed weight of the sand-island fill and carrying some of that sand with it into the wells. After the sand from the first blow-in had been dredged from the wells, the caisson sank 2 ft under a continuation of the dredging, and another blow-in occurred under the same conditions as the first. The caisson remained vertical and in the correct plan position.

This trouble was given considerable study, and a number of suggestions were made for improving the practice from this point. Higher lifts of concrete were proposed to obtain more weight and hence more rapid cutting; filling the dredging wells with a head of water 6 or 8 ft above river level to build up positive pressure inside the caisson was suggested; and also dredging down the sand-island material to within 10 or 20 ft of the river bottom, so as to reduce the outside head and the skin friction, once the cutting edge had entered the actual river bottom. Previous practice had been to keep the sand-island fill above high water, obviously building up a considerable head outside the caisson as well as tending to hang up the caisson with friction. Since the quality of the concrete might suffer if higher lifts were used, and since the caisson had not been designed for an added head of water in the wells, only the dredging of the sand-island fill was undertaken. This was not carried as low as suggested, for side friction was counted on for caisson stability. However, the tendency of this friction to hang up the caisson was an undoubted factor in permitting blow-ins during the subsequent dredging. With only one more blow-in, a minor event at El. −75, Pier 3 was successfully carried to its planned elevation at El. −170, and sealed with the tremie.

The most spectacular blow-in occurred on Pier 4, the last caisson to be sunk, just before it was to be sealed. The cutting edge was entering good sand at El. −165 but was held up by the friction of some hard clay which had just been penetrated. It was thought that clay walls were holding up the interior cutting edges, and small charges of dynamite were being discharged below the edges to break down these walls when suddenly the caisson dropped 3 ft to the accompaniment of a blow-in. About 8,000 cu yd of material moved up into the caisson, rising 66 ft above the cutting edge; water rose high enough above that to blow out the cofferdam above the top of the caisson on the river side; and the steel shell of the sand island settled, tearing down 25 per cent of the falsework on the river side and pulling the island shell into an elliptical shape. This was the concluding trouble, and after the material had been cleaned out the pier was carried down the remaining 2 ft and sealed in August 1934, completing the most hazardous feature of the work.

Pier A behind the levee on the west bank of the river was founded on an open caisson without sand island. The west bank here had been subject to scour, and, when the government issued the permit for the bridge, it agreed to maintain the levee in position in front of Pier A and to provide bank protection. This protection has recently been placed in the form of an asphalt mattress. The footings of the land piers, B, C, and D, on the east side were placed on pile foundations. This work offered no particular difficulty.

The floating concrete plant used for substructure work on the river was of the most modern type, with the latest mechanisms for weighing, batching, and measuring materials. It contained two 2-yd mixers, capable of producing 120 cu yd of concrete per hour, and was equipped with boilers, elevators, material derrick and bins, and a 120-ft steel tower. For the construction of the upper

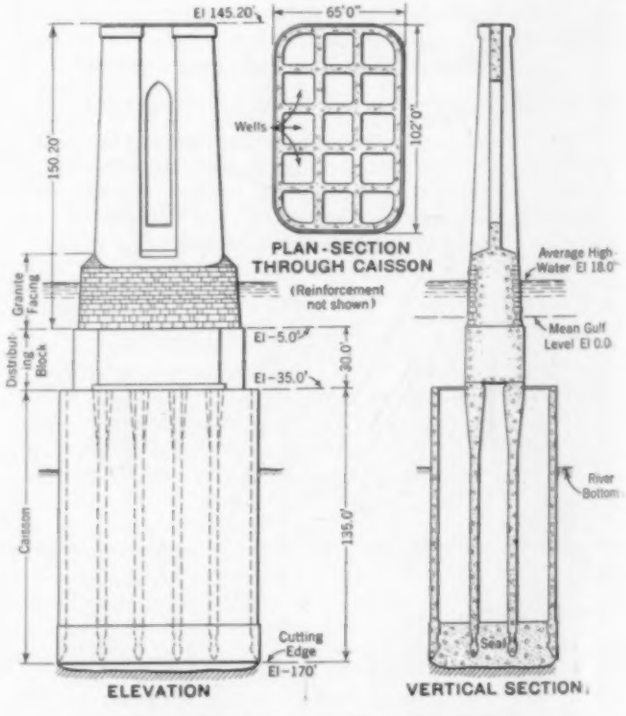


FIG. 4. ELEVATION AND SECTIONS, PIER 1

shafts of the main bridge piers, which reach El. +145, a special tower derrick was built. This consisted of two barges framed together, which supported a structural steel tower 100 ft high, having a stiff-leg derrick on top, and was equipped with hoisting engine and boiler plant.

By the close of 1934, Siems-Helmers, Inc., contractors for the main bridge substructure, had completed their work after proceeding almost without interruption even from the periodic high water of the Mississippi. In spite of the difficulties encountered, the sand-island method proved a very satisfactory means of founding the deep piers at New Orleans.

ERECTION OF SUPERSTRUCTURE AND APPROACHES

The main bridge superstructure was built by the American Bridge Company, beginning in February 1934. The three deck spans adjacent to the New Orleans side were first erected on a series of falsework bents. For the through spans over the river, the balanced cantilever guy-derrick erection method was employed. An adjustable erection bent was placed near Pier 2 and another near Pier 1, permitting steel to be erected in both directions from each of these two principal piers. The derricks were moved forward on skids resting on the stringers of the railway floor, erecting truss members ahead of them, and turning around to fill in the other members behind them.

GENERAL VIEW OF STEEL ERECTION

The Through Spans Were Erected by the Balanced Cantilever, Guy-Derrick Method

On the cantilever, work proceeded from Piers 1 and 2 toward the center of the suspended span, and the two halves were joined when they met at the center. Adjustment had been provided in the two top-chord members at the ends of the suspended span and in the bottom-chord member at the tip of the west arm to permit bringing the two halves into position for closing. This adjustment was made by use of 500-ton jacks acting through three-to-one levers. During the cantilever erection the changed lengths of the variable members were maintained by shims, which were removed during the closing operation after the loads were first picked up by the jacks and then progressively decreased.

After the completion of the principal cantilever span, the 531-ft 6-in. simple through span to the east was erected by cantilevering out from the east anchor arm and landing the steelwork on successive falsework bents. The only important delay encountered in the erection of the main bridge steelwork occurred during the construction of this span. At the end of March 1935, the cantilever had been closed and about half of the simple span cantilevered out from the east anchor arm, when the river current and quantity of drift increased in one of the periodic risings of the Mississippi. An attempt to move a falsework bent to the midpoint of the simple span at that time revealed difficulties in keeping the necessary barge truss assembly under control, and it was not until early in June that the assembly and cage could be moved safely. Meanwhile, considerable scour had taken place at the site of the proposed bent because of a temporary structure at that point, so that, in all, considerable trouble was experienced as a result of these flood waters. High water during this period reached a stage of 17.2 ft, and did not really begin falling until late in July. This was one of the longest periods of continued high water on record, as it usually begins falling about the first of May.

The approach substructures, consisting largely of concrete pedestals with footings supported on timber piles, were begun early in 1933 by the MacDonald Engineering Company and were substantially completed by May 1934. Individual and group tests of these piles were made to measure settlement under design loads. Concrete for more than half of each approach was transported from mixer to location by pumping through pipes. Temporary interruptions to the work sometimes caused the hardened concrete to block the pipe, with considerable loss of material and delay during the removal of the blocked section of pipe.

By June 1933, the approach substructure work had progressed to the point where the McClintic-Marshall Corporation, contractors for the approach superstructure, could begin erecting their steelwork. This consisted of a series of trestle bents supporting girders up to 82 ft in length. Approach steel erection followed the substructure construction closely, and work under this contract was completed with the placing of the railroad deck in December 1934.

BRIDGE TYPIFIES ADVANCE IN CONSTRUCTION METHODS

The finished cantilever structure of the New Orleans Bridge embodies almost the ideal form suggested by stresses, and is probably as attractive as can be expected of a bridge of the cantilever type. With an extensive use of silicon steel and heat-treated eye-bars, it typifies the advance in uniformity of mill work since the time when Captain Eads first employed steel in his bridge at St. Louis and found himself in continual battle with the contractors to obtain reliable material checked by tests. In addition, the foundations required by the conditions at New Orleans would have offered insuperable difficulties in those early days. The scientific planning of modern engineering work has overcome most of the difficulties presented by large undertakings, even where the natural obstacles are great.

The opening of the bridge is now contemplated in December 1935. It was built jointly by the State of Louisiana, and by the City of New Orleans acting through the Public Belt Railroad Commission. The cost of the finished structure will be about $13,000,000.

Engineers for the design and supervision of construction were Modjeski, Masters and Case, Inc., while Moran and Proctor were the consultants to the engineers on the main bridge foundations.

The Lake Okeechobee Project

A $17,000,000 Improvement in Florida Combining Flood Protection and Navigation

By EARL I. BROWN

MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS

COLONEL, CORPS OF ENGINEERS; DIVISION ENGINEER, SOUTH ATLANTIC DIVISION, U. S. ENGINEER DEPARTMENT, RICHMOND, VA.

TOWNS and farms on the shores of Lake Okeechobee, Fla., have been laid waste at rather frequent intervals in the past by tropical hurricanes which literally blew a great part of the lake out of its bed and onto the surrounding lowlands. In this article, abstracted from a paper presented before the Construction and Highway Divisions on October 17, 1935, at the Birmingham Meeting of the Society, Colonel Brown describes the protective works now under construction by the Corps of Engineers. The interests of navigation have been combined with those of flood protection, and the completed project will provide a barge channel across the peninsula.

THE hurricane in the vicinity of Lake Okeechobee, Fla., this past September, vividly recalls the disastrous hurricanes of 1926 and 1928, and invites attention to a review of the protection works now being constructed on that body of water. Lake Okeechobee (Fig. 1) is about 30 miles in diameter and, at its normal surface elevation of 15 ft above sea level, covers about 725 sq miles. It is in the path of the annual tropical storms and has up until the present year been viewed as a potential zone of danger every autumn.

Lake Okeechobee is fed by three streams, all on the north, having a combined watershed of 4,176 sq miles on which the average annual rainfall is from 45 to 60 in. Under former natural conditions the only discharge from the lake was by overflow southward into the Everglades—a vast low-lying plain covered with saw grass and dotted with palm islands and cypress ponds. Over a large part of this plain there is a peaty muck soil, the fertility of which makes the section attractive for the production of a variety of crops.

Drainage has always been the prime necessity in this region, and following a hundred years of local and relatively unimportant attempts to drain the Everglades, serious efforts to that end were begun by the State of Florida about 1913. Between that year and 1926 four drainage canals were dug from the lake in a generally southeastern direction to the Atlantic Ocean, while to control the lake elevation two larger canals were constructed—the St. Lucie, leading east to the Atlantic, and a canal from Moore Haven westward through Lake Hicpochee to connect with the Caloosahatchee River. Low levees were built along the south shore of the lake. The St. Lucie Canal has been the principal avenue of discharge because of the short distance to the ocean.

Then came the hurricane of 1926, with a peak wind velocity of 120 to 135 miles per hour. It pushed a vast amount of water over the low levees into the Everglades and inundated the town of Moore Haven, drowning a good many people and inflicting a large property loss along the lake shore. Before the region had well caught its breath it was visited by the 1928 hurricane, of even greater intensity on the lake itself (Fig. 2). This storm caused far greater losses of life and property than the earlier one and practically demoralized a vigorous and growing section of the state.

Local resources being unable to undertake adequate flood protection work, the federal government was petitioned for aid. The Act of Congress of July 3, 1930, authorized a federal project, and the work of providing protective works was delegated to the Corps of Engineers, U. S. Army. The act provided for: (1) Substantial levee protection to all valuable sections of the lake shore; (2) the straightening and enlargement of the Caloosahatchee River to form a channel at least 6 ft deep for barges from the Gulf to Lake Okeechobee and to provide additional discharge capacity from the lake; (3) improvement of Taylor Creek by dredging; and (4) improvement of the St. Lucie River and protection of the St. Lucie Canal, already dredged by the state, from erosion and silting to insure a discharge capacity of 5,000 cu ft per sec and a navigable channel from the lake to the Atlantic Ocean. This capacity, with 2,500 cu ft per sec through the Caloosahatchee River, will permit the lake to be controlled under normal conditions within a 3-ft range of elevation.

PRINCIPAL FEATURES OF THE PROJECT

The Lake Okeechobee project, as it is popularly called, involves at present the following items (Fig. 3):

1. Construction of 83 miles of levee. Fifteen miles on the north shore of the lake are being planned and should be under contract by the end of the year. The other 68 miles have been brought to a stage of completion at this writing which insures safety to the south-shore communities.

2. Excavation of 18 miles of floodway channels, connecting at two places the deep water of the lake with the navigation channel that for the most part lies adjacent to the levee on its lake side, and dredging a navigation channel in Taylor Creek from the lake to Okeechobee City.

3. Deepening, widening, and straightening 66 miles of the Caloosahatchee River.

4. Construction of 6 hurricane gates and 18 drainage culverts at various points in the levee.

FIG. 1. VICINITY MAP OF THE LAKE OKEECHOBEE PROJECT, FLA.

5. Construction of 16 drainage spillways along both sides of the St. Lucie Canal to protect that channel from silting and erosion.

6. Construction of a navigation lock at Ortona, in the Caloosahatchee River. It should be added that the hurricane gate at the Caloosahatchee River entrance at Moore Haven forms the upper gate of a lock at this point.

The project, representing $17,200,000 in cost, is now over three-quarters completed. It extends from the Atlantic to the Gulf of Mexico and provides barge transportation, maintains the present irrigation water supply, and affords complete hurricane flood protection to thousands of acres of fertile soil and many hundreds of prosperous inhabitants.

METHODS OF LEVEE CONSTRUCTION

In general, the crown of the levees is about 19 ft above normal lake level. Originally a crown elevation 3 ft lower had been planned, the designs calling for a levee with a muck core covered with $2^1/_2$ ft of riprap on slopes and top. It was believed that such a levee would be safe even though the lake elevation during a hurricane might exceed the previous record and overtop it.

When it was shown by subsequent investigations, however, that rock in sufficient quantities was not available in the region to construct a rock-paved levee, the design was altered to flatter slopes and the crown elevation was raised 3 ft to provide a freeboard of $4^1/_2$ ft above the record elevation. Three main methods were employed in constructing the levee—a straight drag-line operation, a straight hydraulic operation, and a combined drag-line and hydraulic operation.

Muck overlying the sand, shell, marl, and rock in borrow pits had first to be removed, as its use in the levee was objectionable. In drag-line work this was done variously by clamshell, dipper, drag-line bucket, and hydraulic

LEVEE UNDER CONSTRUCTION BY DRAG-LINE
The Waste Bank on the Right Separates the Improved Barge Channel from the Lake Proper

dredge, but the latter type of machine was early seen to be the most efficient. Most of the muck stripped was removed by a 10-in. pipe-line dredge and deposited to lakeward of the toe dikes thrown up parallel to the navigation channel and levee by clamshell or dipper dredges.

For straight hydraulic work the muck was pumped simultaneously with the sand, shell, marl, and rock. The muck, being lighter, was not retained in the fill but ran off with the waste water.

In all locations where muck was encountered in the levee base, a fire toe trench on the land side and a seepage toe trench on the lake side were excavated and filled with marl as a safeguard against fire hazard from the land side and seepage from the lake side. Where deep muck was encountered in the levee base, shrinkage and subsidence became difficult problems. The subsidence was approximately 35 per cent of the original depth of the muck when the fill was placed to its ultimate height.

By using a large drag-line machine working in an unwatered pit formed by the toe dikes and two cross dikes, one contractor found he could excavate the channel, reveal soil and rock layers, excavate and lay at convenient places the rock later to be used for riprap, and build himself a berm on which, on the return trip, he could work the large machine to complete the channel excavation and pile up most of the prism material. Three smaller drag-lines shaped up the section. Not at all places, however, could such a simple method be employed.

PLACING LEVEE FILL BY HYDRAULIC DREDGE
The Baffle Boards Facilitated Distribution of the Pumped Material

Another contractor combined drag-line handling and shaping of the levee prism within protected sections with hydraulic fill from 16-in. pipe-line dredges. The hydraulic machines pumped in most of the fill by excavating the navigation channel. Baffle boards enabled very neat work to be done in distributing the pumped material and bringing prism sections up to gross grade and to line. Drag-lines were then used to dress the fill.

In all these operations, blasting was resorted to to reduce the rock layers, from 2 to 4 ft thick in places, to pieces of the proper size for the hydraulic machines to pump or for the other machines to handle. The use of dynamite greatly facilitated the work where the subsoil was too hard to handle with machines alone.

Work begun on the west shore primarily by hydraulic methods was so satisfactory that the same principles were embodied in later work on the east shore. With a rugged cutter ladder and powerful cutter engine, a toothed rock cutter, and adequate pumping power, a government hydraulic dredge cut its way through the sand, shell, marl, and rock without blasting. Clever baffleboarding controlled the deposit of fill to specific grade and line. Toe dikes thrown up previously by drag-lines delimited and impounded the levee fill itself.

With the levees finished to line and grade, the fill was sodded, and riprap was placed at the toe of the slope.

METAL CULVERTS PROVE MORE ECONOMICAL THAN CONCRETE

The locality is subject to heavy rainfall, and the four state-built drainage canals are frequently incapable of carrying off excessive rainfall to the ocean due to their small size and slight slope. To relieve flood conditions on the lands immediately bordering the lake, drainage through the levee into the lake has been provided at a number of places through culverts. These culverts consist of one or more barrels of 10-ft diameter pipe with reinforced concrete headwalls. Drainage into the lake is effected by pumping into a leveed basin from which the water discharges through the culvert into the lake. The length of pipe barrels varies with the width of the levee sections from a minimum of about 90 ft to a maximum of 160 ft. The invert of all culverts is 8 ft below normal lake surface. All culverts are equipped at the lake-side ends with automatic flap-valve California-type gates.

A Three-Barrel Drainage Culvert

A Spillway on the St. Lucie Canal

The Hurricane Gate at Canal Point

THE LAKE OKEECHOBEE PROJECT REQUIRED MANY STRUCTURES OF THE TYPES PICTURED HERE

Alternate designs were made to compare metal pipe culverts with reinforced-concrete box-type structures 8 by 10 ft in section. With the latter type, foundation piles would have been needed at most locations throughout the entire length of the barrel, while with the metal culverts, except for some headwall foundations, no pile support was required. The estimated erection costs also favored the metal culverts.

The secondary function of the culverts is irrigation. At the pumping stations used for draining the land, these culvert inlets afford means of turning water from the lake onto the land, which during excessively long dry spells might dry out and become a fire hazard. However, the value of irrigation uses here is yet in need of conclusive proof, and it is the drainage function that is paramount.

The 7,000-lb cast-iron flap-valve is swung on two link-hanger bars pivoted on the periphery of the valve and supported by wall bearings anchored to the concrete headwall. The rim of the valve, under slight excess pressure from the lake side, seats against a seal ring anchored in the headwall, so as to close the pipe completely. As little as 0.1 ft of head built up on the land side of the valve, however, causes release of the gate from the seat and permits discharge into the lake. The flap-valve can be lifted up out of the line of flow by means of a portable tripod carrying a small chain hoist. Anchorage for the valve in the open position is provided. To avoid air-pocketing, each pipe is vented above high water by a small pipe terminating in the lake side headwall.

Between headwalls the 10-ft diameter pipe was made up in the field of corrugated metal plates 4 ft 6 in. wide and 10 ft long and $^{7}/_{32}$ in. thick, curved to a 5-ft radius. The plates are of copper-molybdenum iron or of pure iron, and with all bolts, nuts, and washers, were completely galvanized with spelter at the rate of 4 oz per sq ft of surface. In addition, before field assembly was begun, the sectional plates were hot-dipped in a bituminous coating. The process of assembly was rapid. The plates were shifted on small cars from the unloading point to the edge of the excavation and then skidded down into the hole.

Invert sections were assembled first. Fine grading of the foundation was done by hand to secure proper alignment. With the invert in place, side plates were bolted up to the horizontal center line. Then the arch sections were placed. In all cases, plates were set so that the load was balanced on both sides to prevent movement or distortion of the partly erected pipe. A small portable gantry erected on the job simplified the handling of the plates.

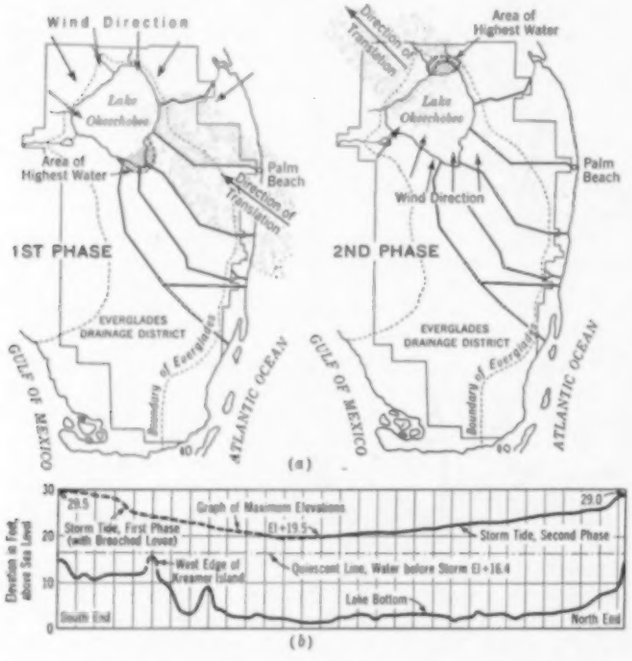


FIG. 2. THE HURRICANE OF SEPTEMBER 1928

(*a*) Wind Directions and Areas of Highest Water During the Two Phases of the Storm, (*b*) Profile of Resulting Maximum Water Surface Elevations in the Lake

SPILLWAYS WILL CHECK EROSION ALONG ST. LUCIE CANAL

The very heavy rains of 1924 caused an excessive run-off from the drainage area of the St. Lucie Canal. At a number of places the rushing streams deeply eroded the loose soil of the adjacent flats and carried sufficient sand into the canal to shoal it heavily and practically stop all drainage and navigation. One of the first things the lake Okeechobee project had to provide for, therefore, was the removal of these shoals. A second and more important objective was the design of suitable structures that would control future runoff discharges through the adjacent washes, so as to prevent the transport of sediment in significant quantities into the canal.

Extensive tests at the U. S. Waterways Experiment Station indicated that a sloping weir provided with a baffle lip on the lower apron would normally produce a hydraulic jump which would check the erosive velocities of the worst flood to be expected in any of the washes. Accordingly, 16 reinforced-concrete drainage spillways were designed and all are now practically completed. In September one of them was severely tested by a cloudburst in its drainage area and functioned perfectly. The hydraulic jump checked the discharge velocity of a 4-ft depth of flow over a weir crest 24 ft long and caused a still pond on the lower apron.

At each of the main canals leading from Lake Okeecho-

bee, it was necessary to provide structures to shut off the lake during a hurricane. The design of these structures involved four fundamental criteria: Sufficient strength to withstand pressure from a 30-ft head plus the dynamic impulse of hurricane wave action; simplicity of operation and ability to operate against a head; positiveness of action; and economy of construction and maintenance. The miter type of gate was first considered but was found to be lacking in one of the fundamental essentials in that it could not be operated against a head. As some of these gates would be in isolated localities, one of their primary purposes might easily be defeated if a sufficient head to prevent their being opened should accumulate before the operator could reach them. The miter-type gate was hence discarded and the sector type substituted.

Each of these gates consists of a pair of steel 60-deg sectors 32 ft high, rotating on vertical axes, meeting when closed on a vertical line at the axis of the lock chamber and swinging when open within two massive, fan-shaped stepped abutments, giving a 50-ft clear channel. Two needle dams are provided to enable repairs to be made in the dry.

The gate sectors are operated by electric motor, and manual operation is also provided for. A horizontal lever actuates a vertical shaft and miter gearing to turn a drum from which cables lead through sheaves to the gate from such directions as to permit opening or closing. To swing the gate through water by hand operation when the lake is at about normal elevation (10 ft above the floor of the channel) requires 82 turns of the hand lever and consumes 10 minutes. As storm warnings will be received by operators at individual gates several hours in advance, there is no danger that gates will not be closed in time to protect the canal against a rising lake.

The hurricane gates serve as barriers to waves during hurricanes and permit the flow of water into and out of the lake during normal times. The gates at Moore Haven and in Taylor Creek permit the passage of barges. Navigation and passage of flood waters through the St. Lucie Canal is provided for by two locks, with collapsible spillways adjoining. In order to prevent the lake from rising to a dangerous height during periods of excessive rainfall, the hurricane gates at Moore Haven and the lock gates and adjacent spillways in the St. Lucie Canal will be used to discharge flood waters, a maximum of 2,500 cu ft per sec being discharged through the Caloosahatchee River and double this amount through the St. Lucie Canal. These discharges are expected to prevent the lake stage from exceeding El. 17. Precise control of the flow through the structure at Moore Haven may be had by partially or fully opening the sectors of the gate to provide a sluiceway of any desired width up to the 50 ft width between the abutments.

NAVIGATION LOCKS ARE PROVIDED IN CALOOSAHATCHEE CANAL

The lock chamber at Moore Haven is 260 ft long, with a lift of 4.5 ft at normal lake stage. The lower gate is a pair of steel cylinder sectors similar in general design to the upper, but only 21.5 ft in height. Filling time for the lock varies from 3 to 7 minutes; the lower pool is normally at El. 11.5 and the lake surface will be maintained between El. 14.0 and El. 17.0. Electricity from Moore Haven will be available for power operation of the gate sectors, although manual operation is provided as an emergency measure.

It is interesting to note that where the sector gates are used as navigation lock gates no valves are required. The lock structure proper at Ortona, which overcomes a 10.5-ft drop in the Caloosahatchee Canal, is similar in size and design to that at Moore Haven, except that the upper gates are of lighter construction. The flood discharge, however, is by-passed around the lock, over a spillway. The latter structure includes 51 ft of free overflow crest, and two 20-ft Tainter hand-operated gates at a lower elevation which can be opened to permit maximum discharge without an excessive rise in water surface elevation in the upper channel.

The Ortona structures have been under way since September 1935, and should be completed late in 1936. Meanwhile, of course, dredging of the Caloosahatchee River below and above Ortona is in progress. This work should be completed by July 1937.

Hurricane flood protection on the shores of Lake Okeechobee would in itself be of great benefit. But the results expected from the completed project are, as we have seen, far greater than this. The social benefits of the improvement are numerous and diversified and will indubitably result in a marked increase in land values throughout the entire area.

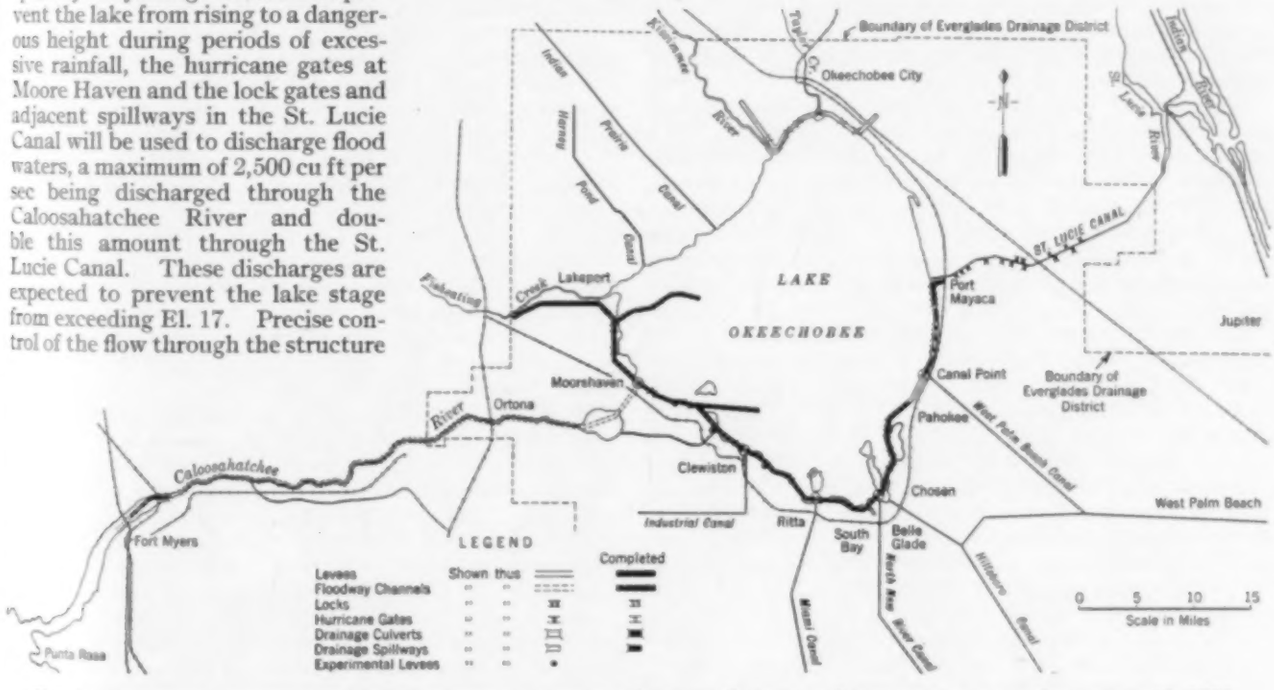


FIG. 3. PRINCIPAL FEATURES OF LAKE OKEECHOBEE PROJECT, SHOWING STATUS OF CONSTRUCTION AS OF SEPTEMBER 19, 1935

Advances in Surveying Technique

Ground, Aerial, and Geodetic Methods Find Wide Application to Work in the South

THAT surveying and mapping are increasingly important factors in engineering work in the South was very evident to an interested group of members who listened to a number of excellent papers delivered before the Surveying and Mapping Division on October 17, 1935, at the Birmingham Meeting of the Society. The order of presentation here is the same as that at the meeting; but the length of the addresses has necessarily been reduced for printing.

Regarding work for the Tennessee Valley Authority, Mr. Sayford's account starts at the beginning, describing the procedures, standards, organization, and lessons learned. Large in area and large in scope, this work has laid the foundations for far-reaching further development. To Mr. Carpenter, it seems inexcusable that highway surveys costing millions of dollars are not given permanent value through preservation. To seek means of preventing this appalling loss, the Texas Highway Department has experimented with a project in Kenedy County, tying the highway survey to geodetic control, with promising results.

For two years Alabama has been using relief workers to extend its local control surveys from the framework of the geodetic control previously laid out by the U. S. Coast and Geodetic Survey. Professor Callan's paper describes the organization of this work under his direction, the progress attained, and some of the problems still to be solved. In the final paper in the symposium, Mr. McKay describes an engineering plan to provide surveys for a pipe line from northern Louisiana eastward into Georgia. Required to make plans and place 100 miles of pipe in 130 days, his staff employed aerial surveys to determine the general alignment. All these papers are distinguished by their primarily practical objectives, intelligently studied and successfully attained.

Surveying and Mapping in the Tennessee Valley

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THE Tennessee Valley Authority's job includes the development of a unified water control plan for the entire Tennessee River basin, an area about as large as an average southern state, drained by 20,000 miles of streams. The most distant tributaries rise in the half-mile-high mountain valleys of the southern Appalachians. They converge at Knoxville to form the Tennessee, which empties at a low elevation into the Ohio at Paducah, 600 miles below. The magnitude of the planning for flood control, navigation, and incidental power is evident.

Planning of this sort requires maps—complete and accurate base maps for general planning, detailed maps of many sorts for the planning of specific projects such as great dams and reservoirs. Planning of any sort, whether regional or local, general or detailed, requires first of all a knowledge of the ground, and the Authority proceeded promptly upon organization to examine the surveying and mapping situation in the Tennessee Valley region.

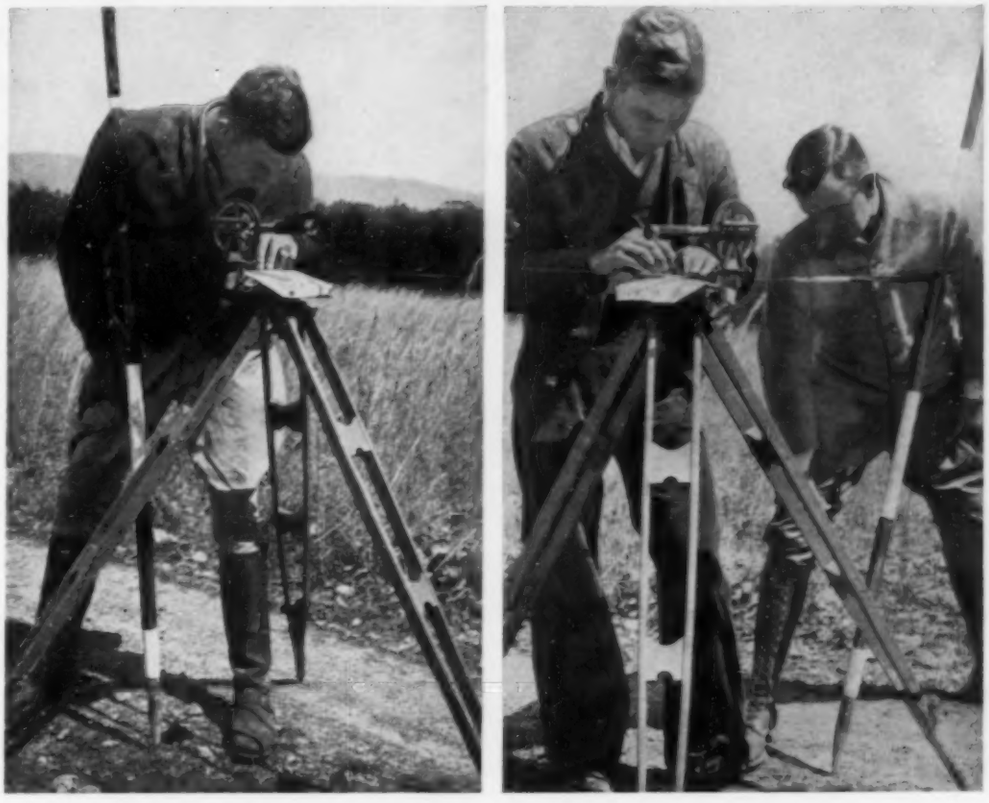
An inventory of the available maps and surveying information brought sharply to light two conditions: First, that the area might be considered as almost unmapped with respect to standardized small-scale, general-information maps, the rather roughly made reconnaissance maps of nearly a half century ago, covering part of the basin, being of little value for present purposes; and second, that as a result of the U. S. Army Engineers' work during the preceding ten years, there was much usable information available for detailed studies, particularly in and somewhat above the flood planes of the Tennessee and its larger tributaries.

The need for standard base maps was acute. In this emergency, the U. S. Coast and Geodetic Survey promptly began to extend its horizontal and vertical control over the Tennessee watershed, giving this area preference in the country-wide program to complete the 25-mile spacing of triangulation arcs and precise level lines. Work was carried on rapidly in the 1933 and 1934 seasons, and by the end of 1934 practically all the basic control had been completed. Almost simultaneously, arrangements were made with the U. S. Geological Survey to complete, under cooperative agreement, the base maps without contours, commonly called planimetric maps, for the entire 42,000 sq miles of the Tennessee basin. Upward of 200 men, with field headquarters at Chattanooga, are working on this job. The scale of these planimetric maps is 1 in. equal to 2,000 ft, and they depict the wooded areas as well as the drainage and the chief cultural features. The specifications as to accuracy and completeness are such that they may be used later as base maps for contouring.

The method used in constructing these maps is novel for so large a project. Briefly, it is that of office compilation from 5-lens aerial photographs, correct geographic position and scale being secured by means of secondary triangulation or third-order traverses, the latter spaced about 5 or 6 miles apart and closed on Coast and Geodetic Survey control stations. The map is then given an overall field check by plane table, the field checker being required either to drive or walk every road and trail, checking distances by automobile speedometer, checking generally by eye such features as road alignment, buildings, and drainage lines, and finally, adding place names and political subdivision lines. Where errors in office compilation are evident, measurements are taken and corrections made. Because of the urgent need for maps, the office-compiled sheets are made available as advance maps even before field checking. There are to be nearly 800 of these $7\frac{1}{2}$ by $7\frac{1}{2}$ minute sheets, the final maps

being reproduced in three colors by standard lithographic processes at the reproduction plant of the Geological Survey in Washington.

The time required to assemble the large force needed to handle this work, to train the men and to get into production, under the most favorable conditions would have precluded the production of maps rapidly enough to satisfy the Authority's need in certain sections of the area. Accordingly, it became neccessary in a number of cases to compile, by quicker methods, some sort of general maps which would serve as stop-gaps until the more accurate Geological Survey maps became available. This was done by what is called the "automobile traverse" method, wherein all the main roads are traversed by automobile, taking distances from the speedometer, and alignment from compass bearings. Buildings, streams, and other features are sketched in their approximate positions as the roads are traversed by car. The traverses originate and close on the control stations of the Coast and Geodetic Survey or other agencies. The speed with which such maps can be produced is remarkable, and their accuracy approaches that of regular plane table maps that would be produced on a scale of 1 in. equal to 2 miles. Providing the roads are drivable, a 2-man party with car will average about 35 miles per day, with a resulting final cost of less than $1 per square mile.



PRECISE TAPING WITH NEWLY DEVELOPED VERTICAL-ANGLE TAPING TRIPODS, TENNESSEE VALLEY AUTHORITY

These Companion Photographs Illustrate Simultaneous Observations at Each End of the Tape

So much for general maps. As for larger scale maps of greater detail—the TVA engineers found themselves fairly well equipped. During the period from 1923 to 1929, U. S. Army Engineers had completed topographic maps of the important river valleys. These maps were made on a scale of 1:15,000, or 1 in. equal to 1,250 ft, and show 10-ft contours.

CONSTRUCTION PROGRAM REQUIRES MAPS

Now with the general mapping program set up, it would seem proper to look ahead for other surveying needs. No need to look far, nor time to look long. Norris Dam was to be started at once. Wheeler Dam followed a few months later, then Pickwick Landing Dam. The huge reservoirs, each invading several counties, requiring together the purchase of ten thousand farms and timber tracts, flooding hundreds of miles of highways, bridges, railroads, telegraph, telephone and transmission lines, cemeteries, water mills, town areas, and the like, called for prompt surveying and mapping services of many kinds and in great volume.

A large organization would be needed without delay. The Army Engineer Corps met the emergency for the Authority without red tape by making available surveying crews which had been hastily assembled for duty on the Cove Creek (now Norris) project, should the War Department be called upon to carry on that project. To these men were assigned the most pressing jobs. Many of them have stayed with the Authority, and a recent check disclosed that most of them have worked their way to higher grades.

Too often on great engineering projects, the importance of having well-executed surveys is obscured by the more glamorous aspects of construction, general planning, and design. The alert young technical graduate who begins as chainman is apt to be drawn away at the first chance to become a concrete inspector, or to help check stress computations. Consequently there is a tendency for the surveys to fall behind the other engineering in quality, and this can and sometimes does cause agony at headquarters.

COMPREHENSIVE SURVEYING DEPARTMENT

It was recognized at the outset that a number of divergent TVA activities would require surveying and mapping service, and it was believed that, to achieve the utmost in quality and effectiveness, there should be set up a separate engineering surveys section, whose function would embrace all the various sorts of surveying, except the layout work incidental to construction. This conception, which looks upon surveying in connection with great construction undertakings as a distinct branch of engineering, to be manned by specialists and separately administered, is perhaps unusual. But the results

MARKING THE 1,100-MILE SHORE LINE OF WHEELER RESERVOIR, TENNESSEE VALLEY AUTHORITY

achieved under high pressure, measured in terms of quality, economy, and timeliness, have firmly established the principle with the Tennessee Valley Authority.

In developing this idea and in creating the necessary organization, now numbering about 250, to make it effective, certain principles have emerged, which now may be considered established policies. The first and most important concerns the personnel. A substantial proportion of the chief men are chosen from among those who have spent much of their professional careers in surveying. Trained leaders, who consider surveying a profession of fundamental importance and who are themselves making it a life work, are essential if the younger men are to become proficient and the surveying staff is to merit the esteem of fellow engineers. A more or less steady drafting of the men for better jobs both within and without the Authority attests to a degree, perhaps, the temper and quality attained, and incidentally provides opportunities for promoting proficient junior men within the survey organization.

Another fixed principle is to cooperate fully with all agencies of the federal, state, and local governments and with private engineers in efforts to pool information and eliminate duplication of effort. An illustration is the help which the Authority was able to give to the Tennessee State representative of the U. S. Coast and Geodetic Survey, in affording him supervisory assistance for the second-order traverse and level control surveys which were executed in the Tennessee basin under the CWA program. Thus the nation-wide control system was augmented and the Authority's control net strengthened.

CONTROL DEEMED PARAMOUNT

Then too, the practice has become fixed of making full use of the principle of good basic control, in order to preserve the effort put into present work for future use, and so that the results of the Authority's surveying and mapping may be fitted to, and made useful in, the surveying and mapping activities of others. This is emphasized as to vertical control, and it has become the policy of this organization to execute all levelling on the basis of the latest sea level datum as established by the Coast and Geodetic Survey, and further, by example and otherwise, to encourage the use of this datum by all those engaged in surveying in the Tennessee Valley area.

All surveys of permanent nature, likely to be of use in the future, such as control, property boundaries, and silt ranges, are monumented at frequent intervals with permanent concrete posts carrying suitable metal plates explaining the nature of the monuments.

It has become clear that to properly balance the cost and time elements, all surveys should be governed by plain specifications, prepared with a full knowledge of their immediate purpose and a real comprehension of the possibilities for later usefulness. To illustrate, demands may be made for topographic maps ranging from perhaps the minutely detailed, showing 1-ft contours and every physical object, to sketchy reconnaissance maps with 10, 20, or 50-ft contour intervals. The survey specifications for securing details for each will be quite different. The maps are produced on original scales appropriate to the accuracy and completeness of the respective surveys, thus self-advertising, to a degree, the quality of each.

The economy of high-grade instrumental equipment soon became apparent. Almost at once it was found necessary to establish a shop for minor and emergency repairs to the nondescript field equipment gathered hurriedly from here and there to begin the work. The predicament of field parties at $1,000 a month, waiting for instruments which were in the repair shop, quickly established for the Authority a policy of buying the best grade of surveying instruments. The change to good standard equipment undoubtedly has had its effect upon the morale.

SURVEYS FOR DAM PROJECTS

Now to illustrate the kinds of surveying that are being done, perhaps there is no better way than to trace briefly the chief surveying and mapping operations performed

in the development of a dam and reservoir project. Let us say that preliminary surveys and studies already have clearly indicated the approximate location and height of a proposed dam.

Then the next item in the reservoir survey schedule is reservoir control, both horizontal and vertical. The horizontal control consists of third-order traverses (1:5,000 accuracy), which will orginate and close upon the nearest triangulation or traverse stations of the Coast and Geodetic Survey. At intervals of about one mile, a station, or pair of stations in the traverse is monumented, using a heavy concrete post in which is embedded a bronze disk. The traverses are located in general on the roads nearest to and just above the future reservoir shore line. Their positions are computed upon their respective state plane coordinate systems, as recently established by the Coast and Geodetic Survey.

Third-order level lines, which constitute the vertical control, follow routes paralleling the traverses and establish the traverse monuments as permanent bench marks. In addition, semi-permanent bench marks are set at such intermediate points as bridge piers, heavy retaining walls, culverts, and building foundations.

MOSAICS FROM AERIAL PHOTOGRAPHS

Simultaneously, single-lens aerial photographs are made of the reservoir area and for a considerable distance around. These photographs are taken to an approximate scale of 1 in. equal to 1,250 ft and must conform to rigid specifications, since they are to be used later as the basis for cadastral surveys. The overlap in line of flight must be not less than 60 per cent, and not less than 50 per cent upon adjacent flights. The prints must be sharp and clear and there must be no discernible tilt. After the photographs are accepted from the contractor, it is necessary that the exact scale of each photograph at a certain datum plane, fixed at about the mean elevation of the terrain photographed, be ascertained. These scales are determined in the field by measuring on the ground the distances between points identifiable in the pictures or, what amounts to the same thing, by identifying control points on the photographs. At the same time, elevations by barometer are secured at the end of the measured lines, so that the scale correction applicable to each picture can be determined for the specified datum plane. Such ground checks are secured, and the true scale computed, for every fourth or fifth picture of each flight, true scales of the intervening photographs being interpolated. With the true scales known, prints ratioed exactly to the scale of 1 in. equal to 1,250 ft are made for use in mosaic construction. Later on, enlargements on a scale of 1 in. equal to 500 ft are made in the same manner, for use in the cadastral surveys.

Controlled mosaics constructed from the ratioed prints on a scale of 1 in. equal to 1,250 ft have proved surprisingly accurate. Tests of the accuracy of the mosaics in territory between control lines thus far have disclosed but slight errors in map position, the greatest discovered to date being about $^1/_8$ in. on the scale of 1,250 ft to the inch. With the addition of the drainage obtained by stereoscope and with field checking of details by automobile, the mosaics and maps traced from them prove useful for a number of purposes.

FILLING IN THE DETAILS

Next comes the detailed topography of the dam site, of the construction camp site, of developed city areas which may be flooded, and of possible relocations for railroads. In all work of this type, regardless of the scales and contour intervals selected, the original of the final map represents the accuracy in horizontal position that should be expected with the scale used. Contour accuracy is kept within the now standard specifications requiring 90 per cent of all elevations scaled from the map to be correct within one-half the interval. In all such work the horizontal control is extended to connect with the reservoir control or other existing basic control of the area, in order that the resulting maps may be plotted on the state plane-coordinate system, thus becoming a part of the national mapping schedule.

Elevations are all based upon mean sea level, as defined by the nearest basic bench marks. A scale commonly adopted for work of this sort is 1 in. equal to 200 ft, the contour interval varying from 1 to 5 ft, depending upon the character of the terrain.

It has been necessary to make detailed topographic surveys over rather large areas in certain cities along the main rivers. These large-scale surveys in urban areas have required traverse and level control. Such control and the city mapping work are usually specified to conform to the standards outlined in the *Manual of City Surveys*, published by the Society. Thus, as a by-product, some of the municipalities in the Tennessee Valley are given a start on standard basic city surveys.

Next comes the marking of the future reservoir shore line, or pool-level contour. This defines the upper limit of reservoir timber clearing and satisfies the needs of engineers, land appraisers and buyers, foresters, land planners, and others for knowledge on the ground of the future shore-line location. The procedure in timbered areas is to paint white rings at the correct elevation, low down on the trunks of trees, and to drive white stakes along the contour in the open. Some 2,700 miles of shore line has been run and marked to date in four reservoirs.

Next in order comes what is, because of its great volume, potentially the most costly of all the general reservoir surveys—the property surveys of the many thousand individual land tracts that must be acquired. In this branch of surveying and mapping, it is believed

TYPICAL TERRAIN IN NORRIS RESERVOIR
A Survey Party Establishing Ranges for the Measurement of Future Silt Deposits

the Authority is among the pioneers. With the costs and time studies now available for the surveys of upward of a quarter million acres of valley farms and wooded mountain tracts, in a region where land records are hopelessly inadequate, there is encouragement for the hope that the methods employed may prove an important forward step in the art of mass cadastral surveying.

VARIOUS TYPES OF SURVEYS

The Authority's land acquisition surveys fall into three classes, divided by differences in the size and value of the

tracts. In the cities the lots are surveyed in the usual way—by tape and transit. But for properties in excess of about 10 acres, which constitute the great bulk of the land takings, a survey method involving the use of aerial photographs has been devised. Such photographs, enlarged to an exact scale of 500 ft per inch, at the elevation of the adopted mean datum plane, are sent to the field for use as plane table sheets, it being recognized that in areas of considerable relief corrections must be made for relief displacement. Property lines and corners already located on the ground and visible on the photographs are merely identified and penciled. Corners unidentifiable on the photograph are established by means of plane table stadia traverses from identifiable positions, with due allowance for relief displacement. Where property line markers are missing on the ground, they are reestablished by conventional methods, but even here the photographs prove an invaluable help. Since they represent a model of the ground, distances may often be scaled instead of taped in the field, and angles or bearings may be obtained graphically or by protractor instead.

HYDROGRAPHIC PARTY USING A DEEP-WATER SOUNDING WHEEL
One Phase of Tennessee Valley Authority Surveying

The photographs then go to the office, where the information is transposed to maps plotted on a scale of 1 in. equal to 500 ft. The maps are based on the reservoir control traverse, the individual pictures being fitted into proper position by means of three-point intersections, supplemented where necessary by center-line traverses spanning three or more photographs. Once the centers of the pictures have been located in their proper positions on the map, it is simple, by means of radial line intersections, to locate in correct map position the principal property corners and other key points. From then on, it is merely a matter of refitting the picture under the map and tracing off the remaining property lines, as well as other features, such as roads, streams, woods lines, and buildings.

Deed descriptions of all tracts to be acquired are then prepared from the information contained on the cadastral maps. The acreage content of each parcel is measured by planimeter. The accuracy obtained is noteworthy, particularly in the eastern part of the basin where the terrain is fairly rugged.

RESULTS ARE GRATIFYING

Comparative transit and tape boundary surveys are made from time to time to test the aerial photographic procedure. The areas planimetered from the photographic cadastral maps are compared with the areas computed from the ground surveys. The median difference for all test tracts larger than 10 acres, thus far reported, is on the order of 1 per cent. The maximum error disclosed to date is about 4 per cent. A comparison of the total areas of all test surveys, aggregating several thousand acres, is reported to indicate an overall discrepancy amounting to a small fraction of 1 per cent. About 6,000 tracts, aggregating more than 400,000 acres, have been surveyed thus far by the aerial photographic method. Costs are less than one-third of the preliminary estimates for performing the work by ground methods in common use.

The surveys just described are for acquisition purposes only. When all land required in a given area is purchased, the outside boundary line of the government property is permanently marked by concrete posts carrying bronze disks set at the angle points. The courses are measured by transit and tape, these traverses in turn being tied to the basic control for the area, thus making it possible to define the position of each boundary monument in the state system of plane coordinates, and to restore lost monuments so long as there remain within reasonable distance other marks which are tied to the basic control of the country.

The foregoing is an outline of the principal schedule of necessary surveys for a typical Tennessee Valley Authority dam and reservoir project. Obviously many other sorts of surveys and related activities are required to service properly the pressing physical readjustments incident to the going projects and to meet the demands of the Authority's heavy program of other planning. Except as other established agencies are able to meet the needs, most of this service is performed by the Authority's own surveying and mapping organization.

Permanent Value for Highway Surveys Through Geodetic Control

By J. C. CARPENTER
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SENIOR HIGHWAY ENGINEER, U. S. BUREAU OF PUBLIC ROADS, WASHINGTON, D.C.

HIGHWAY surveys, as now made, are planned and executed with sufficient accuracy, commensurate with their cost, to serve the primary purpose of a control for construction procedure for a particular project or route. The idea that they may be utilized for any further service has never been given any very serious thought by engineers or surveyors.

It would be difficult to determine, with any degree of accuracy, the total annual expenditure for highway surveys and the preparation of plans for the entire United States. For the ordinary high-type surfaced road, surveys and plans may conservatively be estimated to cost, as a minimum, 2 per cent of the construction cost. On a $600,000,000 program, it is safe to say that the cost of

surveys and plans will be at least $12,000,000. After the projects are constructed, there is very little value remaining for this expenditure for surveys. Plans are filed away until the road becomes obsolete and reconstruction becomes necessary. When this time arrives, the old plans are resurrected and an attempt is made to use them as the basis for new work. Usually it is found necessary to make an entirely new survey.

TRIANGULATION NETWORK AS A BASE

With the general adoption of long-time planning, highway locations will become more stable and this will create a demand for better and more dependable surveys. Our profession should assume the leadership in planning, not only in the purely engineering phases but in the economic, fiscal, and all related activities for the development of the country. The fundamentals of any plan must be fixed and permanent, but there must be a reasonable amount of flexibility, for planning is a continuing process and not a formula. The adoption of the U. S. Coast and Geodetic Survey network of primary triangulation as a control for all surveys and mapping is undoubtedly a fundamental in the process of planning, for it insures an absolutely dependable basis for all work and provides for continuing utilization of all previous expenditures.

If there is such a thing as an ideal plan for a highway system, it would be one designed to serve all future traffic with the ultimate of economy in transportation costs. Locations, once established, would never be changed. Provision for adequate right of way for all future needs would be arranged. Construction would be completed to care for the present traffic, but maximum salvage value would be obtained when increased traffic required a change in type. No one individual or group of individuals can hope to possess the wide vision or foresight necessary to lay out such an ideal plan, but engineers are best qualified in any planning movement designed to realize this ideal. This argument leads to the conclusion that our work should be as nearly permanent as is reasonably possible, and the idea of permanency should logically begin with the highway survey.

Accuracy is one of the requirements of all good surveys. The degree of accuracy is usually determined by the relative cost of the proposed improvement. An earth graded road is not considered to require the high precision necessary for an expensive high-type pavement.

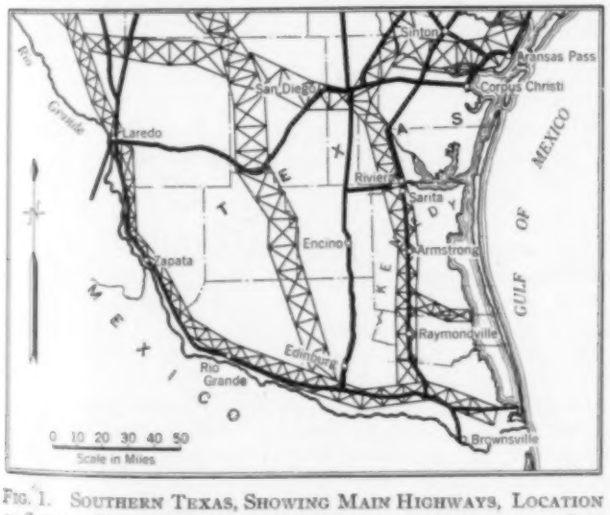

FIG. 1. SOUTHERN TEXAS, SHOWING MAIN HIGHWAYS, LOCATION OF SPECIAL PROJECT IN KENEDY COUNTY, AND APPROXIMATE RELATION TO ADJACENT TRIANGULATION NETWORK OF THE U. S. COAST AND GEODETIC SURVEY

But the total cost of a survey, assuming that skilful direction is employed, is not greatly increased through careful attention to accuracy. The adoption of the method of geodetic control for highway surveys will not materially increase the cost, and it is entirely probable

PART OF FIRST-ORDER TRIANGULATION PARTY ON WAY FROM MCALLEN TO SAN ANTONIO, TEXAS

that after survey crews are properly trained the cost of surveys may be reduced. Even if there were a material increase in cost, the asset of permanent information gained for use in future work, the stabilization of land boundaries, and increased accuracy would be many times more valuable than this added expense.

Highway engineers have an opportunity to render a signal service to the public by taking the lead in the adoption of geodetic control for surveys. Public highways in the United States total three million miles, or one mile to each square mile of area. It is not anticipated that geodetic control can be established for every mile of public highway but, for the major highways that reach all important parts of the country, such control is possible and entirely practicable. The main highways may be assumed to cover about 400,000 miles, or one mile to each 7 of area. The U. S. Coast and Geodetic Survey's network of 116,400 miles, or one to each 26 of area, indicates a spacing about four times as wide as the main highways. These are average figures and may be criticized for covering too much territory; but they do, nevertheless, give a relative idea of the comparative spacing of the two systems and thereby indicate that the task of extending geodetic control to highway surveys is not insurmountable.

APPLIED TO TEXAS HIGHWAYS

The Texas network of primary triangulation of the U. S. Coast and Geodetic Survey includes 6,900 miles, which is approximately one-quarter of the state highway mileage, agreeing with the ratio just set forth. The primary arcs are so located that many surveys can be directly tied to these primary controls without extending the surveys, and as these surveys are carried across the areas between the arcs the control may be extended to other surveys of all kinds. The Texas Section of the Society, in October 1933, requested the Coast and Geodetic Survey to compute the tables for use in converting spherical to plane coordinates. This work was promptly initiated and completed. The survey and the tables are now available for the use of all engineers. With the recent issuance of Special Publication No. 189, *First-Order Triangulation in Texas*, the application of geodetic control to all surveys becomes relatively simple and easy.

The Texas State Highway Department is now developing a trial project with the expectation of formulating a procedure to be used in future survey work in the state. This project is located in Kenedy County, almost at the southern tip of Texas (Fig. 1), and extends down through

the entire county, a distance of 46.6 miles. It lends itself admirably to the use of geodetic control, as it is located within the area covered by the primary triangulation along the ninety-eighth meridian arc. One of the objects of this study is to obtain cost data on the use of geodetic control as compared to the cost of ordinary surveys. It may be contended that a project so ideally located is

CAMP OF FIRST-ORDER TRIANGULATION PARTY IN BENJAMIN, TEXAS

not representative, but this argument does not apply for it is anticipated that all projects in the first selection will be relatively close to the primary arcs and that after the method is well established, survey parties will become more proficient in its application and can extend the process to surveys more remote from the main network. Selection of a project requiring considerable survey work to reach the primary arc would have complicated the computations and rendered it difficult to make a satisfactory check on the work, and probably would have discouraged further study of the method.

On the Kenedy County project there are 14 primary stations adjacent to the project and 10 supplementary points, all of which are within sight of the survey and can be tied in by triangulation or direct measurement. Some of the primary stations are close enough to the line to allow observations and check measurements to be made. The plane coordinates of all primary stations, all supplementary points, and all angle points in the survey will be computed, and the azimuth, distance between points, and various other data will be obtained. All this information will be collected, summarized, and recorded for the purpose of establishing a procedure to be followed in working out other problems of this nature. Eight-place logarithmic tables are required for the computations. The ordinary engineer's handbook does not contain these tables, and special tables must be obtained.

BASIC ADVANTAGES ARE GAINED

The use of geodetic control for highway surveys offers the following advantages: (1) The establishment of accurate locations for all angle points on the survey, with the result that the points may be reestablished in their original position at any time and that there will be on file in the central office of the Department absolutely accurate data from which projections of future work may be made; (2) the establishment of a coordinated method of location which may be used to determine with unquestioned accuracy the relative location of all points on the whole system and thus provide a stable and permanent foundation for all future planning and estimates; (3) the stimulation of a desire for accuracy in all surveys, which will be reflected in all work based on the original survey; (4) the extension of the control to outlying communities, where it may be used as a basis for all surveys and, by setting an example for accurate work, may improve the quality of all dependent surveys; (5) the establishment of a framework for the control of mapping data in the state and consequently the simplification of the task of standardization and coordination of all mapping data.

It is entirely within the realm of possibility to provide for a reasonably accurate topographic survey covering a belt extending for a mile or more on each side of important highways. With the center line accurately located, the value of such information would be greatly enhanced. These data would be extremely valuable in planning all future developments, in studying stream flow and soil erosion, in estimating maintenance requirements, and for many other purposes.

The value of sea-level datum for levels based on the bench marks established by the U. S. Coast and Geodetic Survey is generally recognized, and engineers instinctively use these bench marks whenever they are readily available. The completion of the Coast and Geodetic Survey's level net makes this procedure so easily possible that there is little excuse for the use of an assumed datum on any future surveys. It is not unreasonable to predict that the use of horizontal control for surveys will become the universal practice. Certainly, when permanent value can be obtained at very little, if any, additional expense it becomes an obligation of the engineering profession to adopt the method of geodetic control for all surveys.

Local Control Surveys in Alabama

By J. A. C. CALLAN

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AFTER almost two years of continuous labor and experimentation to develop the best solution for the problem of conducting control survey work in Alabama as a relief activity, it is helpful to review our work—to set up a profit and loss statement, as it were. When I was asked to undertake direction of this work, early in December 1933, under the U. S. Coast and Geodetic Survey, it seemed a formidable task. After a hasty organization period of two weeks, our survey work was launched with a staff of 273 men. These had been selected out of 1,100 applicants interviewed. Most of the men had had experience only in highway and railroad engineering, although some had done land surveying. Graduates from all branches in engineering were chosen, provided they had had some surveying experience. In addition, correspondence school graduates in civil engineering were selected on account of the mental vigor which such men frequently possess.

About 80 transits and levels were borrowed as well as 50 auto trucks and cars. Five divisions were selected

with headquarters (Fig. 1) at (1) Birmingham, in Jefferson County; (2) Selma, in Dallas County; (3) Auburn, in Lee County; (4) Fairhope, in Baldwin County; and (5) Mobile, in Mobile County. Alabama has had only its northeastern part covered with geological maps. A good part of this area was plotted 40 years ago. Much of the mapping was on a small scale, which of course means that it has only limited value.

In Fig. 1 is shown the area covered by the primary geodetic control of the triangulation network in the state. Much of this area was surveyed before the U. S. Coast and Geodetic Survey made a practice of placing azimuth markers for each station at distances of 1,500 ft or more. At the time these stations were put in, it was not anticipated that state surveying forces would have need of the true geodetic azimuth at these points. Now it is found highly desirable to have these azimuths, especially as land values have increased enormously in the past fifty years.

The Survey has projected three other areas (Fig. 1) wherein to locate primary stations and azimuths. The northern one will tie into the Birmingham area conveniently.

In the Jefferson County Division a secondary system has been developed (Fig. 2). Around Birmingham, where the atmosphere is very smoky during the day, resort has been had to night work, by means of signal lights furnished by the U. S. Coast and Geodetic Survey and by auto headlights. The results have been excellent, some sights being 18 miles long.

The very rough topography has made it difficult to get traverses. Also, much outlying territory is heavily wooded and this has caused trouble in getting sights along the ridges and hills, without towers. However, use has been made of some of the airway beacons and also of an elevated water tank, station *Smyer*, which is the highest point in the county and commands sights of 30 miles or more. This triangulation system is tied into both Howard University and Birmingham Southern College campuses, the base line being on the former. As will be noted from Fig. 2, the system is tied into the primary stations *Laurel* and *Kahatchee* lying in counties to the eastward.

Main offices for the state survey were in Auburn, in the engineering building of the Alabama Polytechnic Institute. Here were commodious quarters with the advantage of many laboratories and instruments. A triangulation network of about 250 sq miles was built up about the towns of Opelika, Auburn, Tuskegee, and Loachapoka.

In Mobile and Baldwin counties, which lie in the extreme southern part of the state on the Gulf coast, the U. S. Coast and Geodetic Survey parties only recently placed about 40 primary and secondary stations through the aid of high towers. Both counties are flat and heavily wooded, preventing long sights from the 5-ft elevation of the ordinary transit. The Survey also left azimuth markers at each station giving azimuths from lengths of 1,500 ft or more. This furnished excellent support for our traverses, which varied from 7 to 25 miles in length. A number of pairs of monuments were located in practically every small town of the county.

The azimuth of each line is available, as well as the X and Y coordinates of each monument. The traverses all followed highways running on north-and-south and east-and-west lines, giving an excellent coordinate system for the location of land. Baldwin County is very large, containing about 1,600 sq miles, while Mobile County contains about 1,200 sq miles. The lands in these counties have been owned by Spain, France, and the United States successively.

A so-called Ellicott stone is located, presumably, on the St. Stephens meridian and to the west of the northern boundary of Florida. It stands about 4 ft high, with a base about 2 by 5 ft, surrounded by an iron fence, and was marked by the King of Spain in 1799. It is supposed to be on the 31st parallel of latitude. State surveyors have been unable to find the Cold Creek pri-

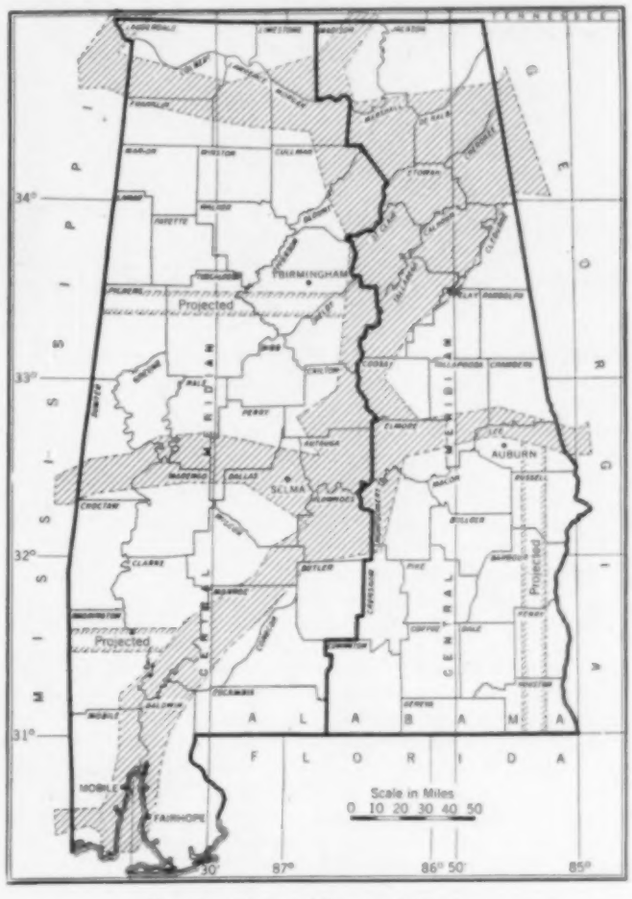

FIG. 1. SKETCH MAP OF ALABAMA
Showing Parts Under Primary Geodetic Control and Division of the State Into Eastern and Western Sections for Application of Coordinate System of Surveys

mary triangulation station with which to check the location of this Ellicott stone.

This suggests that all state and county corners should be accurately located on the geodetic network, and their coordinates computed. No large errors could then accumulate when one attempted to collect a number of county maps out of which to make a state map. A considerable number of discrepancies have cropped out in trying to do this with Alabama County maps. It is hoped to bring this clearly to the attention of the state authorities by specific data, as soon as time permits.

SPECIAL PROCEDURES DEVELOPED

In practically all cases traverses followed highways, but level circuits followed both railroads and highways. Elevations were taken on all our traverse monuments as well as on our triangulation networks. In the Auburn sector, level circuits were run far to the southward to project into the southern part of Alabama, which has had little attention so far by the U. S. Coast and Geodetic Survey, although an arc is now planned to run through it northward from the Florida state line to the arc

passing north of Auburn. Good results were obtained from our level circuits, as tied into primary circuits.

Monuments were set in pairs about 3 miles apart, the individual ones being $^1/_4$ mile apart. These monuments, 3 ft 6 in. long, range from 8 by 8 in. at the top to 12 by 12 in. at the bottom. The usual disk was set in mortar in the center of the top. Later the top dimension was increased to 10 by 10 in. A 1:2:4 concrete mix was used.

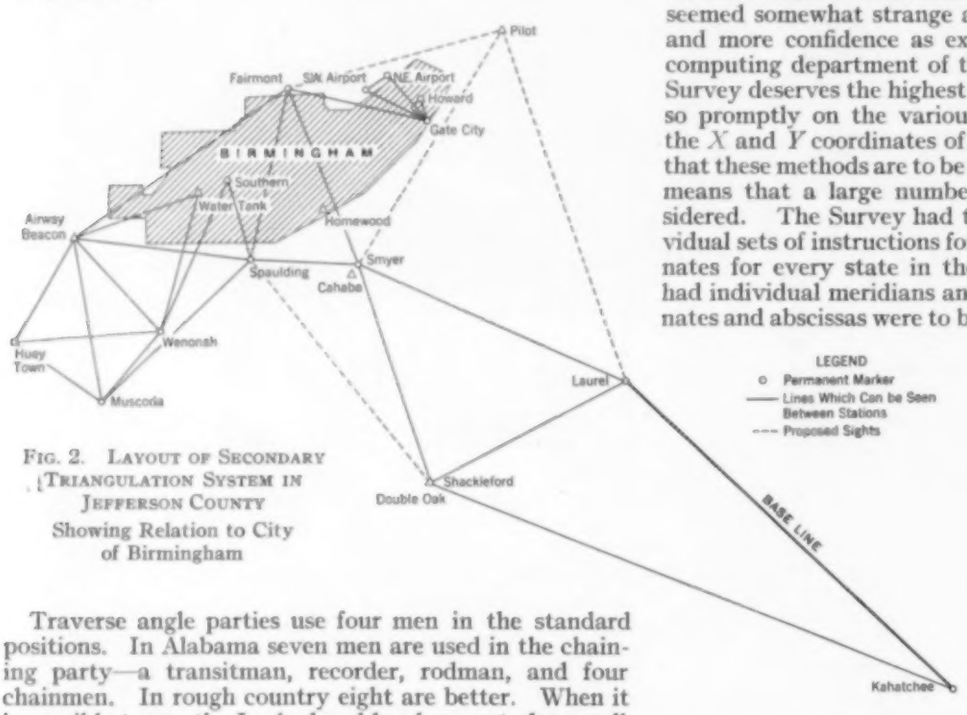

FIG. 2. LAYOUT OF SECONDARY TRIANGULATION SYSTEM IN JEFFERSON COUNTY
Showing Relation to City of Birmingham

Traverse angle parties use four men in the standard positions. In Alabama seven men are used in the chaining party—a transitman, recorder, rodman, and four chainmen. In rough country eight are better. When it is possible to use the Locke hand level, we get along well with seven men, using a hinged rod. This rod has an auxiliary sliding piece 1 by 2 in. in section that can be clamped at any position, permitting the hinge, or zero point, to be set at the height of instrument. The rod is graduated in feet and tenths upward and downward from the hinge. The variation in the height of the chaining table head can be read very conveniently either by the transitman, using the transit as a level, or by the hand-level man, who may also be acting as the recorder and standing at the 50-ft point. When the terrain is not rough, this method works well. The transit is used as a level for differences in elevation between the ends of the tape of 4 ft or more.

Experiments have been made on several types of chaining tables. One is entirely of wood, with tripod legs adjustable in direction. The latest model, Fig. 3, has a catenary-like head, which is assumed to be such that on steep slopes the tape may be placed tangent to the table head at a very short distance from the center. In general, also, it was found best to keep the same man in each division in immediate charge of the selection and placing of monuments on the traverses. Skill comes from practice.

For the heliographic apparatus, a mirror about 6 by 6 in. in size was mounted on a base, centered over the point sighted. The mirror base was made so that it could be rotated about its vertical axis like a transit or level, and the mirror itself was adjustable for tilting about a horizontal axis perpendicular to the general direction of sight and about 1 ft in front. Also in the general direction of sight was a vertical board with a slit in it to prevent the flash from appearing too wide for accurate centering of the vertical cross-hair. Mirrors were also used as signals to indicate when sights were being taken, when to stop, when results were unsatisfactory, and similar messages. Sidereal observations were used in checking computed azimuths at times.

A STATE COORDINATE SYSTEM

Alabama was placed on the traverse Mercator system for its X and Y coordinate system. While this system seemed somewhat strange at first, we have gained more and more confidence as experience was widened. The computing department of the U. S. Coast and Geodetic Survey deserves the highest credit for its ability to decide so promptly on the various schemes for projection for the X and Y coordinates of the various states. The fact that these methods are to be used from now on indefinitely means that a large number of factors had to be considered. The Survey had to develop complete and individual sets of instructions for computations for the coordinates for every state in the Union, every one of which had individual meridians and parallels from which ordinates and abscissas were to be computed. The necessary tables for the constants and the scale factors for the varying latitudes and meridianal distances had to be properly placed, and computed.

Alabama was divided into two parts, eastern and western (Fig. 1). The eastern centers on the 85° 50′ meridian, and the western on the 87° 30′ meridian. On the south the 30° 30′ parallel of latitude is used for the zero Y ordinate for the eastern part, and 30° 0′ for the western part. Both parallels are beyond the limits of the state boundaries, so that the Y ordinates are always positive for both parts. The 31° parallel is the northern boundary of Florida.

From the officers of the Coast and Geodetic Survey down through the supervisory staff of the Alabama State work, each executive is constantly asking himself this question: "In what way is the work from day to day adding definitely to the permanent value of the horizontal and vertical control?" To this end they have continually demanded of the surveying force:

1. That all work be thoroughly and properly monumented;
2. That these monuments be built well and located with skill;
3. That they be adequately and properly referenced;
4. That the data regarding these monuments be intelligently selected and precisely taken;
5. That the notes be properly formulated, the monuments indexed and numbered, and the data made easily accessible to the public; and
6. That the necessary computations and, if necessary, maps be made as soon as possible.

Since the old section corner system was developed with insufficient accuracy, it cannot be accurately replaced. Geodetic control could be replaced easily if a large area of any state were devastated. It is both permanent and accurate. In time it will come to serve as a substitute for the section corner system with its many irregularities. It might of course be used to save the older system.

Little has been said here concerning costs. We have made some traverse surveys on our work for $50 a mile;

some for $150 a mile; and some are still unfinished. Where traverses are long, the problem of getting accurate results becomes very complex, requiring the most careful attention to the minutest details if endless checking is to be avoided. Unit costs rapidly increase if more and more vigilance is not exercised as the length of the survey increases.

Part-time work by all workers, meager funds for equipment and transportation, low wages, constantly changing personnel, rent-free and seldom repaired instruments, red tape, insufficient supervision, inexperienced personnel, desultory outlook, and the feeling on the part of many workers that the FERA owes them a living—all have combined to handicap the work at times. These efforts in Alabama have, however, strengthened our belief:

1. That real effort should be made in every state to have the *X* and *Y* coordinate plan accepted to supplement the section corner system;
2. That each state should have a central mapping authority, as Iowa has undertaken; and
3. That the program of local control surveys should be pushed as rapidly as possible.

It is hoped that a means may be provided so that those who are forced to be on relief may continue to earn a living by following their chosen occupation instead of being called on to labor in lines with which they are not familiar and which therefore they cannot follow efficiently. The Society should lend its best efforts toward a national mapping plan, which is so urgently needed.

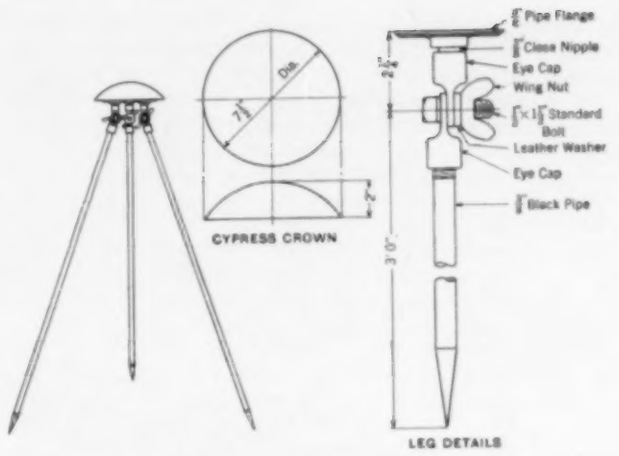

FIG. 3. GEODETIC CHAINING TRIPOD, AS USED IN ALABAMA, WITH CATENARY SHAPED HEAD

Our new project bearing the caption, "Alabama Coast and Geodetic Survey and Engineering Service," has just been approved and, under WPA, will operate on a basis of 219 men for one year. The writer will continue as state director with Henry Steddman of Tuscaloosa as chief engineer.

Natural Gas Pipe Line Located by Aerial Maps

By N. R. McKAY
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EMPLOYMENT of aerial maps on any kind of location is justified when recent maps are not obtainable. Any locating engineer familiar with their advantages will use them, especially if time is short and money not too scarce. In a territory for which reliable and recent maps are obtainable, and which is accessible by ordinary means of travel, the cost of aerial maps is a bit more than that of a complete reconnaissance. In wild or unmapped territory, their use can save both time and money.

An illustration is the location of the gas transmission lines of the Southern Natural Gas Corporation, a 1,250-mile pipe-line system (Fig. 1) designed to transmit natural gas from the Monroe and Richland fields in Louisiana on the west, to industrial and domestic markets in Mississippi, Alabama, and Georgia toward the east. The promotional work had been done, the preliminary designs completed, and a system layout approved; but, with the exception of a hasty automobile reconnaissance, no field work had been done prior to February 20, 1929. A condition imposed by the financiers was that 100 miles of pipe must be in the ground by July 1, only 130 days later.

Before a foot of pipe could be laid, rights of way had to be secured. That required the making of surveys and the preparation of maps. A field and office force had to be organized, and concurrently, materials purchased, contracts awarded, men and machinery assembled. The spring of 1929 was one of the wettest this section has known, and pipe laying is conducted in the open, subject to all the interruptions incident to wet weather. Ditch walls cave when water-soaked; protective coatings will not stick on wet pipe; trucks and heavy machinery bog down in the mud; and efficiency is impaired when everybody gets wet and stays wet.

AERIAL SURVEYING ADOPTED

It was evident that a great deal of work had to be performed in a short time. The conditions favored the employment of an aerial survey, and a contract was awarded to the Edgar Tobin Aerial Surveys of San Antonio, Tex. The first guide panel for the aviators was set on February 21, and on March 15 over 800 miles of line, and several hundred square miles of mosaic, had been paneled and mapped. In the Louisiana section, surveys were begun a few days ahead of the completion of the aerial maps, but no party was long in the field without a photographic location covering its particular section of the line. By April 15, there were 490 miles of main-line surveys completed; contractors were at work by May 1; and at the dead line, July 1, a length of 104 miles of pipe was in the ground.

Setting the guide panels was the first step in making the aerial survey. These panels were placed in the four corners of areas to be covered by mosaics, at the beginning and end of a line, at major angle points, and along the line from 12 to 20 miles apart. Locations at intersections of the route with railroads, highways, and rivers were first selected and the intermediate panels placed at approximately equal intervals. They were made of white cloth, staked out on the ground, in the shape of the capital letter "L," the long leg 60 ft long and 6 ft wide, pointing north, the short leg 30 ft long and 6 ft wide, pointing east. They were located in the open where they were plainly visible from the air.

Locating the panels on the ground was a matter of

projecting the system layout onto county maps, selecting the panel locations, noting the quarter section containing the panel position, looking up the ownerships in that quarter section, and finding the owner of the particular parcel on which the panel was to be placed. It was a waste of time to ask the natives where a certain section corner could be found, as not one in twenty could tell in which section his own land lay; and the deeds were generally at the bank, with the mortgage. But anyone could give directions, of a sort, for finding Dick Roe's house.

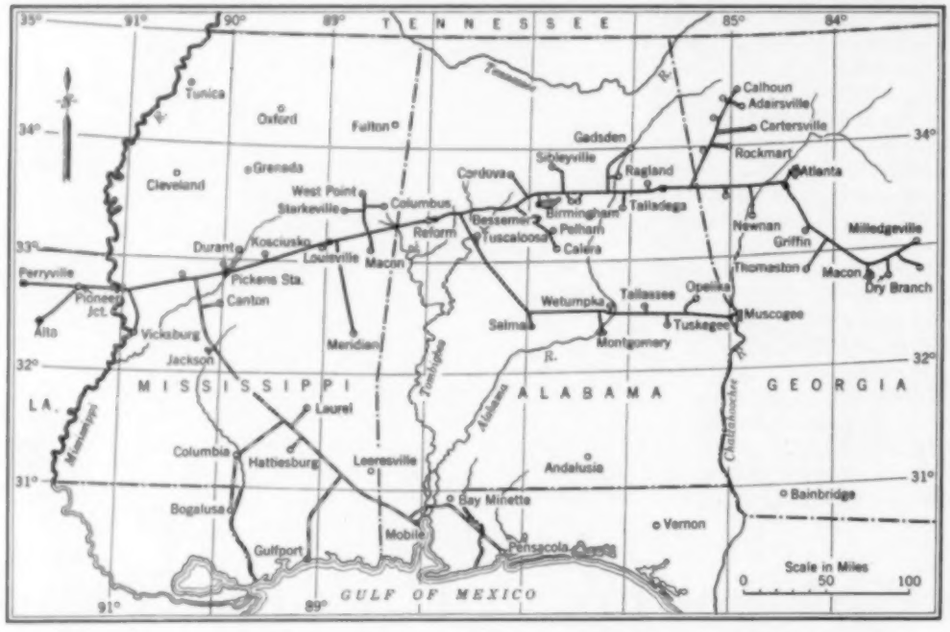


FIG. 1. PIPE LINE OF SOUTHERN NATURAL GAS CORPORATION—GENERAL LOCATION For Distributing Natural Gas from Eastern Louisiana Eastward as Far as Georgia

MAKING PHOTOGRAPHIC MAPS

Picture flights were the next step. They could be made only on very clear days, so it was necessary for the aviators to make preliminary flights over the line as soon as panels were set, marking their location and selecting distant sights on which to fly when making the picture flight. Panels often disappeared a few days after placing, and entire dependence on them was not wise. The ship used for the flights was an old-type army bomber, excellent for this kind of work, as it possessed great inherent stability and flew at slow speed, about 85 miles per hour. Flights were made at an altitude of 10,000 ft plus the elevation of the terrain. It was possible to photograph 400 miles of single line per day, or about 300 sq miles of mosaic. It is indicative of the state of the weather at the time that three weeks were required to complete what was ordinarily a five-day job.

The camera was an Eastman K-5, with a 10-in. focal length lens, using 75-ft films, each accommodating 100 exposures 7 by 9 in. Exposures were made approximately every 15 to 20 sec. The pictures overlapped about 60 per cent along the flight, and about 30 per cent between strips in a mosaic. The scale of the photographs was approximately 1,000 ft to the inch—"approximately," because the pictures were not rephotographed to correct for obliquity or scale. When the prints from these films had been matched, cut, and pasted on cloth strips, the result was a fairly authentic, complete, and up-to-the minute topographical map, showing details in true relation, if not to exact scale, for a width of about $1\frac{1}{2}$ miles.

As soon as a section of aerial map had been completed and delivered, the map location was made. The map as furnished was a picture of a narrow strip of country along a course fixed by the system layout. The selection of this route was influenced by certain important requirements: It must pass close to the large loads; it must be straight between control points; it must cross rivers at proper angles and at points where a crossing is practicable; and it should traverse the best terrain in the territory, avoiding apparently unsuitable areas shown on existing state, county, and geological maps. Thus the map location was confined to the selection of one of several possible lines within the limits of the strip.

The ideal pipe-line location, seldom if ever realized, is a straight line from beginning to end. But deviation from a straight line is necessary when confronted with such natural obstacles as swamps, rivers, lakes, streams which have preempted the ground, high hills, and deep ravines; and artificial obstacles such as towns, communities, farm buildings, river, railroad, and highway crossings, and cemeteries—especially cemeteries, which may have but few gravestones but are absolutely immovable obstacles nevertheless. Every angle, whether horizontal or vertical, is an added expense and a friction generator, so the best line is that which has the least number of angles, other things being equal.

In Louisiana and parts of Mississippi, where the country is flat and the important obstacles are the swamps and rivers, the narrow parts of the swamps and the selected river crossings were taken as the main controls. The most satisfactory line was inked, and the map was ready to be copied for the use of the field parties.

In the hilly sections of Mississippi, Alabama, and Georgia, the map location was not so simple. In the hills, a good pipe-line location is as straight as possible but generally follows important ridge lines; avoids rocky hills where excavation is difficult, deep ravines, badly eroded slopes, or inacessible territory; passes from ridge to ridge down and up the easiest slope offered and in a direction perpendicular to the contours.

For stereoscopic examination, the single 7 by 9-in. photographs, in the order in which they were taken during the flight, were arranged successively in a strip, with the photograph axes parallel and at a distance apart governed by the characteristics of the stereoscope. Because of the 60 per cent overlap, any terrain feature appeared in at least two successive photographs, and each view was obtained from a slightly different angle.

As was the case in flat-country location, control points were first established. These points were generally road, railroad, and river crossings, and compressor station sites. Tangents connecting the control points were then transferred to the pictures arranged for stereoscopic

examination. Several practicable locations would be considered and transferred to the strip map, where they could be studied as continuous lines.

SURVEYING FOR FIELD LOCATION

As soon as a section of map location had been completed, copies were made and divided among the survey parties, 30 to 50 miles to each, depending on the character of the country, whether wooded, open, or a mixture of both. If it became necessary to show the projected line to contractors and right-of-way buyers ahead of the survey, all roads and trails at line crossings were flagged with colored cloth placed on trees and fences. The party placing these flags also made an automobile log of the route by which the line could be followed throughout the network of roads and passable trails. The aerial map, with all details plainly shown, simplified the work of establishing the points at which the line crossed a road or trail, and of tracing the projected line in advance of the survey. The entire length of the branch line from Tuscaloosa, Ala., to Columbus, Ga., was marked in this manner, and maps traced from the pictures were furnished the abstractors and right-of-way buyers, permitting them to get a considerable number of options in advance of the survey.

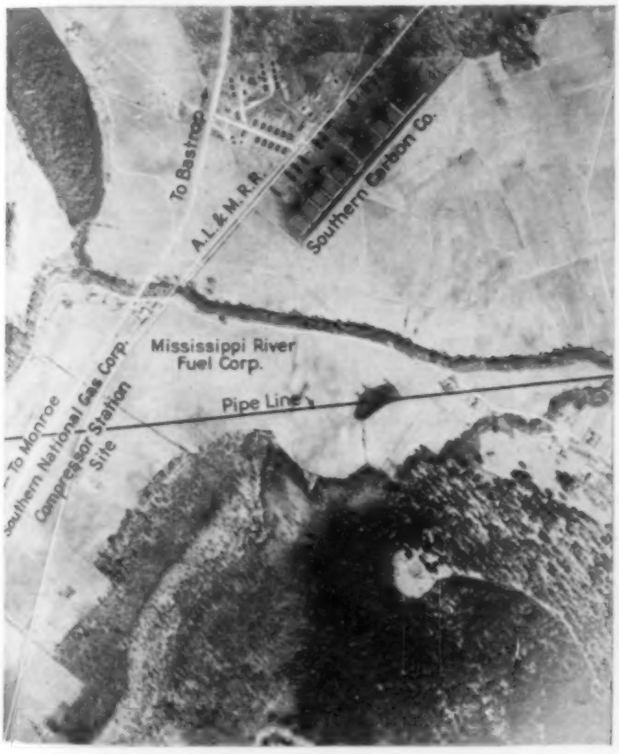
Laying down the photographic location in the field presented few difficulties, except in heavily wooded country. Usually, at fairly close intervals, there were features shown on the picture by the aid of which the field man could progressively plot his position. If the courses were short, they were easily adjusted to the terrain, but a close calculation of the forward course became necessary when it had a length of several thousand feet and apparently had been closely fitted to a stretch of rather rough topography. For this condition, we found that a straight line drawn down the center of the strip picture would serve as a base line to which all courses could be referred, and the angles could be read by protractor or calculated by tangent distances scaled from the photographs. This method would be subject to only a small amount of error if the photographs could be assembled in the map with any degree of precision, or if there were no distortion or obliquity.

Although the photographs were matched with great care, they did get out of line a little, and distortion was present, particularly at their edges. I believe that this objectionable characteristic of the photographs we used in 1929 is eliminated with the present improved apparatus and photographic technic, but in the making of strip maps the ground control necessary to secure an accurate scale would not be justified. The approximate scale of our maps was sometimes annoying, but was not a serious defect, everything considered.

NOTABLE BENEFITS DERIVED

The chief advantages secured by the employment of aerial maps on this particular project were as follows:

1. An authentic and up-to-date map, embodying all the information necessary for a complete map location, was obtained in the shortest possible time.
2. An acceptable location was secured with the first survey, and with a minimum of revision due to mistakes in fitting the line to the ground.
3. Several survey parties could work simultaneously on different sections of the line, with absolute assurance of a good closure on the line ahead.
4. Property, county, and state lines were usually plainly shown, simplifying the work of tying in to established corners and markers.
5. Abstractors and right-of-way buyers could work from sketches traced from the pictures and were not obliged to wait for surveys.



AT THE BEGINNING OF THE 1,200-MILE PIPE LINE
Air Map Near West End of the Line, Near Perryville, Between Bastrop and Monroe, La.

AIR MAP OF LINE IN ELMORE COUNTY, ALA.
Guide Panel of White Cloth at Point Marked Ties Into Ground Survey; Photograph from 10,000-Ft Elevation

The Bessemer High School Stadium

Presenting Some New Developments in Welded Steel-Plate Deck Construction

By W. N. Woodbury

Engineer, Virginia Bridge and Iron Company, Birmingham, Ala.

In view of the increasing interest of the public in football, many smaller colleges and high schools are seriously considering better and more comfortable seating facilities for spectators at contests. While the use of a riveted steel-plate deck for a stadium is not new, the advent of welding has decreased its cost and insured that it will be watertight. The accompanying article, abstracted from a paper read by Mr. Woodbury on October 17, 1935, before the Structural Division at the Birmingham Meeting of the Society, describes one of the most recent developments in welded steel deck construction, discusses the merits of various types of seats, and enumerates some of the more general principles followed in modern stadium design.

As a solution of the football stadium problem no feature was overlooked and none over-emphasized in the Bessemer stadium, which is located in the city of Bessemer, Ala., 16 miles west of Birmingham. The structure is 288 ft long by 51 ft deep, and has a seating capacity of 3,230. The space beneath the deck is arranged for a field house, and includes team, locker, and equipment rooms; concession space; offices for coach, manager, and caretaker; and ticket offices, boiler room, showers, and toilets. Access to the stadium is provided at the center and the ends. The ticket offices are located at the ends of the stand and spectators will enter only at these points, the large center opening being used as an exit. The center ramp also leads to the concession booth and to the toilets. The rear of the stadium is adjacent and parallel to a main thoroughfare in a residential section of the city, at present only partially built up, permitting ample parking space for a stand of this capacity.

The structure consists of a steel frame surmounted by a steel deck, with brick walls enclosing the rear and ends. Ceilings are provided over the rooms beneath the stand. Structurally there is nothing unusual in the construction, with the exception of the water-tight welded steel-plate deck.

Characteristics of Welded Steel Deck

Steel-plate decks have been used in stadium construction for some years. The *Engineering News-Record* of February 22, 1923, and the *American Architect* of April 11, 1923, describe an all-steel stadium for the University of Iowa, which was built from the design of B. J. Lambert, M. Am. Soc. C.E., professor of civil engineering at that university. This type of construction, which has been duplicated in several other stands, utilizes deck plates bent to a *Z*-shape, lapped, and riveted. The riser portion of the plate, combined with a portion of the tread, forms the structural member spanning between supports. Cast-iron or steel seat brackets are fastened to the steel plates and the wood seats carried thereon. Stands of this type, in use for twelve years and less, show little or no deterioration and have required no maintenance except painting.

With the advent of welding in the field of structural steel fabrication, marked improvements have been made in steel decks. They are now constructed with all seams welded, which permits more economical use of material, simplifies fabrication, decreases erection costs, and ensures water-tightness. Riveted joints are generally not water-tight to even a hose test without calking or welding. On the Bessemer stadium a welded steel, water-tight deck is used.

In developing the welded steel deck, tests were made on full-sized plates bent in the shape of an *L*. For test purposes a rise of 8 in., a tread width of 26 in., a length of 15 ft 0 in., and a thickness of $^3/_{16}$ in. were adopted. It was believed in using these dimensions that 15 ft represented the maximum length and $^3/_{16}$ in. the minimum thickness that is desirable. The plates were tested in groups of 3 without welding, to determine whether they had sufficient strength individually. Sacks of rivets were placed on the plates until there was an average load over the entire area of 230 lb per sq ft. Under this loading the middle plate of the three showed a deflection of 1 in. Upon removal of the load, the steel returned to its original position. This indicated a strength equivalent to a 7-in., 9.8-lb, structural channel, and further indicated that about 75 per cent of the horizontal part of the plate acts as flange area.

Stadium decks are generally designed for a total load of not over 110 lb per sq ft. This is specified in many building codes and may be accepted as an assumed total load. A stand loaded to capacity carries an average live load of 40 lb per sq ft. Allowing 100 per cent for impact, the total is well under the assumed load of 110 lb. It was determined, therefore, that under normal conditions a $^3/_{16}$-in. deck would have ample strength without welding the seams. Welding, therefore, would be necessary only for water-tightness. Further tests were made on the midpoint deflection of 26-in. treads. A load of 240 lb, when concentrated at a single point, caused a local deflection in the tread of $^1/_{16}$ in. In practice $^3/_{16}$-in. plates are used for treads up to 28 in. wide, and $^1/_4$ in. for wider treads.

An important feature in welded deck plate construction is simplicity in erection. The small angle lugs for interlocking the plates are welded in place in the fabricating plant, and straps are welded to each end for connection to the steel supports. A bar is also welded to one end of

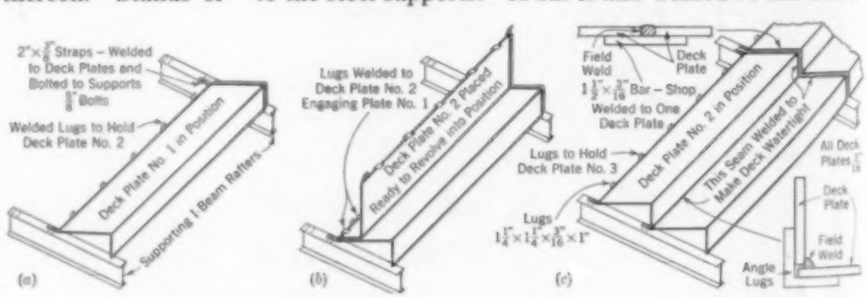

2" × 5/16 Straps – Welded to Deck Plates and Bolted to Supports
5/8" Bolts
Welded Lugs to Hold Deck Plate No. 2
Deck Plate No. 1 in Position
Supporting I Beam Rafters
(a)
Lugs Welded to Deck Plate No. 2 Engaging Plate No. 1
Deck Plate No. 2 Placed Ready to Revolve into Position
(b)
Field Weld
Deck Plate
1 1/2" × 3/16 Bar – Shop Welded to One Deck Plate
Deck Plate No. 2 in Position
This Seam Welded to Make Deck Watertight
Lugs to Hold Deck Plate No. 3
All Deck Plates 5/16
Lugs 1 1/4" × 1 1/4" × 3/16" × 1"
Deck Plate
Field Weld
Angle Lugs
(c)

Fig. 1. Method of Constructing Welded Steel Deck
Showing Successive Steps (from Left to Right) in Placing and Fastening Plates

each deck plate to project under the adjacent plate and thus facilitate welding of end seams. The method of erection and the various parts are illustrated in Fig. 1. In Fig. 1(*a*) a single plate is shown in position, with angle lugs for interlocking with plate No. 2 and straps for connecting to the I-beam rafters. This plate is bolted to the rafters before plate No. 2 is erected. Fig. 1(*b*) shows plate No. 2 placed on top of plate No. 1. The lugs on the two plates are staggered and the plate edges are in contact. As plate No. 2 is revolved these lugs interlock and hold the plate edges together. In Fig. 1(*c*) is shown plate No. 2 in position and bolted to the I-beam supports. It will be observed that each successive plate covers the connections of the plate below and that, on the completed stand, no connections are visible.

BESSEMER HIGH SCHOOL STADIUM FROM CENTER OF STAND

As all welding is performed from the upper surface of the deck, high speed is possible. Time studies on the Bessemer stadium indicate that 70 sec is the time required for erecting a deck plate. The welding proceeds simultaneously with the building of the brick walls below the stand.

Seat design is intimately related to tread width, as seats which are flush with the face of risers require wider treads than those that overhang this face. In seat bracket design, strength is but little more important than comfort, particularly that phase of comfort which can be designated as foot-room. Brackets for use with the welded steel deck were designed for field-welded connections to avoid any punching of the deck plates. Various types were tested both for vertical load and resistance to sway, and final selection of the size of material to be used was made on a conservative basis, making allowance for the variation in efficiency of field welds. Some of the types tested are shown in Fig. 2. In Fig. 2(*a*) the bracket projects about 6 in. beyond the face of the riser, allowing sufficient room for the feet when spectators are passing. Figure 2(*b*) illustrates a modification of this arrangement, which gives a more comfortable seat. Figure 2(*c*) shows full overhang beyond the face of the riser and can be used with a tread width as narrow as 25 in. Seats with backs, such as are shown in Fig. 2(*d*), have been used in baseball stands. The back supports, of course, necessitate an increased tread width.

PROBLEMS INVOLVED IN LAYING OUT A STADIUM

The stadium architect or engineer should be consulted on many problems in addition to the actual design of the structure. The selection of a site is of vital importance and often receives scant attention. The best site is a high level area with access from both sides and ample parking space. Such a site requires a minimum of grading, permits the use of the space beneath the stand, and is free from serious drainage problems.

In general the axis of a football field should run in a north-south direction. Where conformity to existing property or street lines is not a factor, the field should be accurately oriented to place the sun's rays at mid-season at right angles to the axis of the field, that is, the axis should be about 30 deg west of north in the latitude of Birmingham.

In laying out the stadium structure, the rise of the seats should be graduated to agree with the sight curve. In steel deck construction this is approximated by a series of tangents. The theory of the sight curve is developed in Serby's *The Stadium*, which allows 6 in. for the sight line of each spectator above the eye of the person in

GENERAL VIEW OF BESSEMER HIGH SCHOOL STADIUM

front. In practice, this dimension may be reduced for small stands located close to the side lines. A clearance of 4 in. for a seat 35 ft from the side lines will give a better view for the average spectator than 6 in. at a distance of 100 ft. Slightly increasing the clear vision line for rear seats tends to compensate for the distance from the field.

Since seats near the center of the playing field are the most desirable, it is important in larger stands, with a capacity of over 5,000, to provide more seats near the center of the field and fewer near the goal line. It has been observed in selling tickets, and in watching crowds in stands where seats are not reserved, that the lower center seats are occupied first, and that, when the stand is partially filled, the spectators form a crescent or half moon. A scientifically designed stand should conform to this same curve. Since such a curve may not be practicable from either a structural or architectural standpoint, a close approximation can be obtained by offsets in the rear of the stadium, which would tend to concentrate seats in the favored section. By introducing a horizontal curve in the stadium structure, the distance from the center of the field of the seats near the goal lines is reduced. In the steel deck stadium, the horizontal curve is obtained by a series of tangents. With spans not exceeding 15 ft, these tangents are within approximately $^{5}/_{16}$ in. of a true curve.

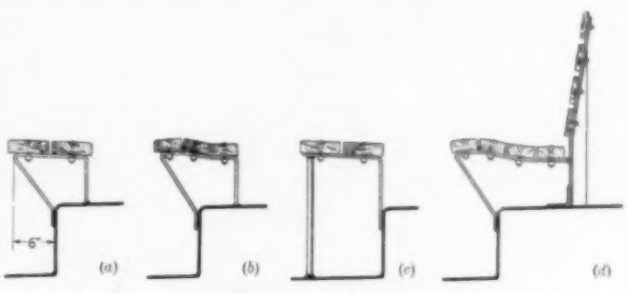


FIG. 2. VARIOUS TYPES OF SEATS WERE TESTED
Supports Were Designed for Welding to the Deck Plates

The Bessemer stadium was built under a PWA loan. The architect was Bem Price, of Birmingham, and the general contractor, Algernon Blair of Montgomery. Although the contract was awarded late in June 1935, the stand was opened for the first football game on September 27. The Bessemer stadium deck was built under a patent.

ENGINEERS' NOTEBOOK

From everyday experience engineers gather a store of knowledge on which they depend for growth as individuals and as a profession. This department, designed to contain practical or ingenious suggestions from engineers both young and old, should prove helpful in the solution of many troublesome problems.

Simplified Solution of Influence Lines for the Reactions of Continuous Beams

By V. L. PIERCE
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INFLUENCE lines for the reactions of any simply-supported continuous beam can easily be obtained, by elementary algebra and arithmetic, from the elastic curve of a similar beam supported at its end points only and subjected to a unit load at some intermediate point. The method is applicable to continuous beams of any number of spans, to those with unequal or unsymmetrical spans, and to those having a variable cross section. It is particularly convenient when the effect of settlement of one or more of the supports is to be studied.

From Müller-Breslau's principle, the influence line for any reaction of a continuous beam is the elastic line obtained when that reaction is removed and the beam is displaced a unit distance at the point of application of, and in the direction of, the reaction; this unit displacement being produced by a load applied at the point of application of the reaction and in the direction of the reaction. This load may be applied mechanically, on models, or mathematically. The mathematical method will be illustrated by a simple example.

Suppose that we wish to determine the influence line for the reaction R_2 in the continuous beam in Fig. 1(*a*). We commence by removing R_2 and R_3, applying a unit load at R_2, and computing the resulting elastic curve (Fig. 1*b*). Now if loads are placed at R_2 and R_3 so that the deflection at R_2 is unity and that at R_3 is zero, the resulting elastic line of the beam R_1R_4 for this new loading will be the influence line for the reaction R_2 of the continuous beam $R_1R_2R_3R_4$.

The magnitude of the loads required to produce this result can be found from Fig. 1(*b*). The deflections at R_2 and R_3 produced by a unit load at R_2 on beam R_1R_4 are seen to be 108,900 and 92,700 respectively; by Maxwell's law of reciprocal deflections (which states that the deflection of a point A from a unit load at point B equals the deflection at point B for a unit load at point A), the deflections at R_2 and R_3 due to a unit load at R_3 are respectively, 92,700 and 108,900.

Now let the required load at R_2 be P_2 and that at R_3 be P_3.

Then, $(P_2 \times 108{,}900) - (P_3 \times 92{,}700) = 1.000$
and $(P_2 \times 92{,}700) - (P_3 \times 108{,}900) = 0.000$
Solving these equations simultaneously, $P_2 = 0.00003334$ and $P_3 = 0.00002838$.

It only remains now to load the beam R_1R_4 with these loads and solve for the resulting deflections or elastic line. This can be done quickly with the aid of Fig. 1(*b*). From this figure the deflections at the various points of the beam are known for a unit load at either R_2 or R_3. The deflections for loads P_2 and P_3 are obtained by multiplying the ordinates from Fig. 1(*b*) by these loads. For example, at Point 5, the deflection is equal to $(0.00003334 \times 63{,}731) - (0.00002838 \times 50{,}569) = 0.690$. The elastic line thus determined is the influence

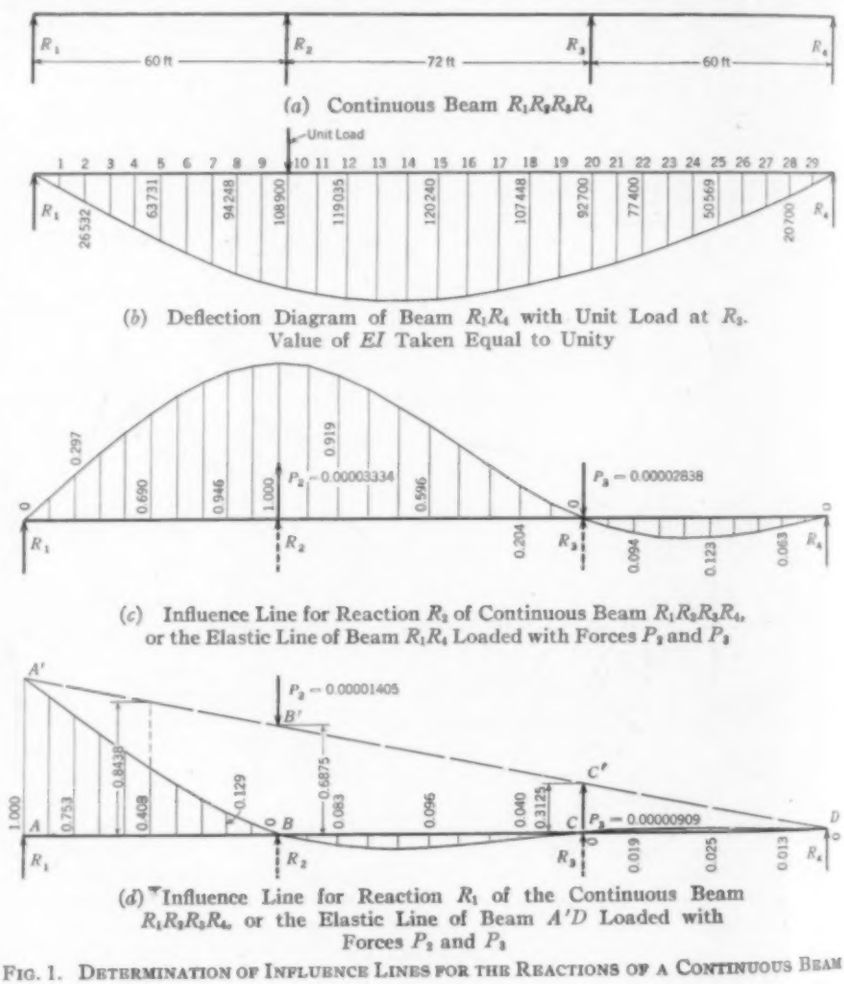

FIG. 1. DETERMINATION OF INFLUENCE LINES FOR THE REACTIONS OF A CONTINUOUS BEAM

line for reaction R_2 of the continuous beam $R_1R_2R_3R_4$.

With the influence line for the reaction R_2 solved, the influence line for reaction R_1 may be obtained by statics, but with about the same amount of effort it is possible to calculate the influence line for R_1 independently of that for R_2.

Assume the left end of the beam AD in Fig. 1(*d*) to be raised to A', a unit distance above point A, without bending. Then the distance $B'B$ is 0.6875 and $C'C$ is 0.3125. Now consider loads P_2 and P_3 on beam $A'D$ of such magnitude that the deflection at B' is 0.6875 and the deflection at C' is 0.3125, both downward.

Again referring to Fig. 1(*b*),

$$(P_2 \times 108{,}900) - (P_3 \times 92{,}700) = 0.6875$$
$$(P_2 \times 92{,}700) - (P_3 \times 108{,}900) = 0.3125$$

Solving simultaneously, $P_2 = 0.00001405$, and $P_3 = 0.00000909$.

With these loads applied as shown in Fig. 1(*d*), point B' is deflected to B and point C' to C, and the elastic line of beam $A'D$ is the influence line for the reaction R_1 of the continuous beam $R_1R_2R_3R_4$. Fig. 1(*b*) is again utilized in solving for the ordinates of this elastic line. For Point 5, the influence ordinate is $0.8438 - (0.00001405 \times 63{,}731) + (0.00000909 \times 50{,}569) = 0.408$.

The problem that has been used as an illustration is simple, but as stated previously, the method may be extended to solve the more complex problems of continuous beams. In any given case, we begin by computing the deflection caused at all points by a unit load applied at any of the interior reaction points with the beam simply supported at the end supports. As the number of spans is increased, the number of simultaneous equations to be solved also increases, but in continuous bridges the number of spans seldom exceeds five.

An interesting point is illustrated by Fig. 2. With the beam R_1R_4 loaded with the loads P_2 and P_3 from Fig. 1(*c*), the resulting reactions, R_1 and R_4, will be equal respectively to the loads P_2 and P_3 of Fig. 1(*d*).

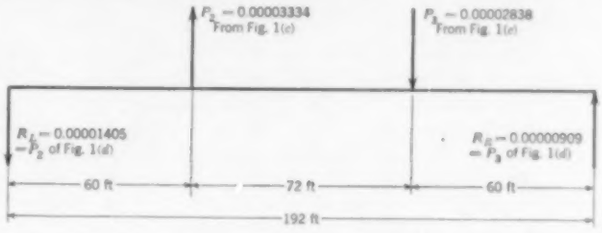

FIG. 2. RELATION BETWEEN LOADING OF FIG. 1(*c*) AND THAT OF FIG. 1(*d*)

In continuous beams of more than three spans, similar relationships occur, from which several of the loads for the various influence-line load conditions may be obtained. It is hardly within the scope of this discussion to show a detailed proof or explanation of this feature.

Stress Analysis for Space Frames

By A. J. S. PIPPARD, M. AM. SOC. C.E.

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SIMPLIFIED methods of stress analysis for space frames are always welcome. One such method was described in the article, "Stresses in Space Structures," by F. H. Constant, M. Am. Soc. C.E., in the May 1934 issue of PROCEEDINGS, page 633. I would like to present here another, which was used extensively in the design of the airship R-101. For the last few years I have introduced it to engineering students at the beginning of their work in the theory of structures and have never found any difficulty in getting them to understand its application.

This "method of tension coefficients" was originated by Prof. R. V. Southwell, of Oxford University, and was described by him in "Primary Stress Determination in Space Frames" (*Engineering*, Feb. 6, 1920, page 165). For a full discussion, reference should be made to the original paper, but its essentials can be given rather briefly and it may be of help to outline it here. (It has recently been called to my attention that an almost identical treatment, unknown to Professor Southwell, was given by Müller-Breslau in 1913 in his book, *Die Neuren Methoden der Festigkeitlehre*, pages 280–360.)

Let AB be any bar in a space frame and let it carry a tensile force of magnitude T_{AB}. If L_{AB} is the length of AB, the force is expressed as

$$T_{AB} = t_{AB}L_{AB},$$

where t_{AB} is the tension coefficient of AB.

Let the coordinates of A and B with reference to three mutually perpendicular axes be x_A,y_A,z_A, and x_B,y_B,z_B. Then the component of T_{AB} acting at A along the x axis is

$$\frac{T_{AB}(x_B - x_A)}{L_{AB}}, \text{ or } t_{AB}(x_B - x_A)$$

Similarly, the components along the y and z axes are respectively, $t_{AB}(y_B - y_A)$ and $t_{AB}(z_B - z_A)$.

At B the components will be

$$t_{AB}(x_A - x_B),\ t_{AB}(y_A - y_B), \text{ and } t_{AB}(z_A - z_B),$$

which are equal in magnitude but opposite in sign to those at A.

Suppose now that in a space frame any number of bars, $AB, AC, \ldots, AQ$, are connected to point A, and that the components of external load at A along the three reference axes are X_A, Y_A, and Z_A.

Then for equilibrium of the joint, the component forces along the three axes must be zero and we have,

$$t_{AB}(x_B - x_A) + t_{AC}(x_C - x_A) + \ldots + t_{AQ}(x_Q - x_A) + X_A = 0$$

$$t_{AB}(y_B - y_A) + t_{AC}(y_C - y_A) + \ldots + t_{AQ}(y_Q - y_A) + Y_A = 0$$

$$t_{AB}(z_B - z_A) + t_{AC}(z_C - z_A) + \ldots + t_{AQ}(z_Q - z_A) + Z_A = 0$$

Three such equations can be written for each joint of the frame. They involve the unknown tension coeffi-

cients of all the bars of the frame and the quantities $(x_B - x_A)$, $(y_B - y_A)$, $(z_B - z_A)$ . . . . , which are the projected lengths of the bars on the three axes and are therefore immediately available from the usual drawings of the frame. Professor Southwell shows in his original paper that a simple manipulation of the equations produces the essential conditions of static equilibrium of the external and reactive forces on the structure. It is only necessary to say here that if there are N joints in the frame we can write down $3N$ equations, from which the 6 reactive forces and the $(3N - 6)$ unknown tension coefficients can be calculated. If the reactive forces are calculated in the usual way from the external load system, $(3N - 6)$ independent equations remain for the determination of the tension coefficients, which have then only to be multiplied by the true lengths of the appropriate bars to give the actual forces.

When forming the equations, all forces are assumed to be tensile; in the solution, a negative value of the tension coefficient indicates a compressive force in that particular bar. A simple example will show the procedure.

SOLUTION OF A TYPICAL PROBLEM

In Fig. 1 is shown a cantilever structure formed of three longitudinal members, *ABC*, *GHJ*, and *DEF*, braced together and arranged so that at any section they lie at the corners of an equilateral triangle. This structure is attached by three pinned joints to a rigid wall. As the framework has 6 nodes apart from these pinned joints on the wall, 18 members are required to make the truss just stiff. These members are provided by the 6 longitudinal members, 6 struts, and 6 diagonals. The loading is shown in the diagram.

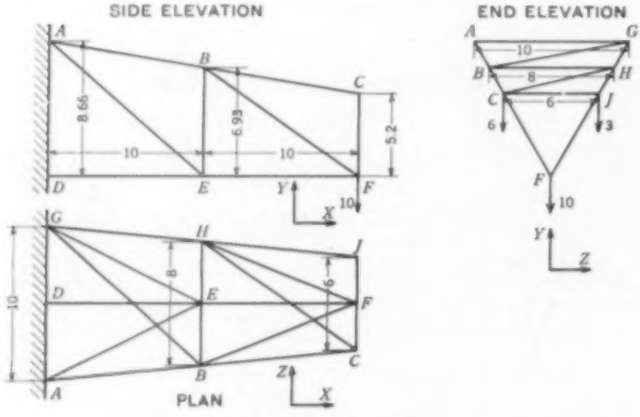

FIG. 1. A SIMPLE SPACE FRAME
The Stresses Produced by This Loading Are Given in Table II

Taking the coordinate axes positive in the directions indicated, and starting with point F, we can set up the equations of equilibrium. The members meeting at this joint are *FE*, *FC*, *FJ*, *FH*, *FB*, and if we consider first the equation for the X-axis, it is clear that *FC* has no component. The projection of *FE* on this axis is -10, that of *FB* is -10, and that of *FH* is -10, so that the equation becomes

$$-10\,t_{FE} - 10\,t_{FB} - 10\,t_{FH} = 0$$

Considering now the Y-axis, the members concerned are *FC*, *FJ*, *FB*, and *FH*. The projections on the Y-axis of *FC* and *FJ* are both 5.2, and of *FB* and *FH*, 6.93. The load is 10, acting in a negative direction, so that the equation becomes as follows:

$$5.2\,t_{FC} + 5.2\,t_{FJ} + 6.93\,t_{FB} + 6.93\,t_{FH} - 10 = 0$$

Similarly, for the Z-axis we get

$$3\,t_{FJ} - 3\,t_{FC} + 4\,t_{FH} - 4\,t_{FB} = 0$$

Following the same procedure at every joint, we get the necessary equations, which are best tabulated as shown in Table I.

TABLE I. EQUATIONS FOR COMPUTING TENSION COEFFICIENTS OF MEMBERS IN A SPACE STRUCTURE

JOINT	COMPONENT ALONG	EQUATIONS
F	x	$-10\,t_{FE} - 10\,t_{FB} - 10\,t_{FH} = 0$
	y	$5.2\,t_{FC} + 5.2\,t_{FJ} + 6.93\,t_{FB} + 6.93\,t_{FH} - 10 = 0$
	z	$3\,t_{FJ} - 3\,t_{FC} + 4\,t_{FH} - 4\,t_{FB} = 0$
C	x	$-10\,t_{CB} - 10\,t_{CH} = 0$
	y	$-5.2\,t_{CF} + 1.73\,t_{CB} + 1.73\,t_{CH} - 6 = 0$
	z	$6\,t_{CJ} + 7\,t_{CH} - t_{CB} + 3\,t_{CF} = 0$
J	x	$-10\,t_{JH} = 0$
	y	$1.73\,t_{JH} - 5.2\,t_{JF} - 3 = 0$
	z	$-6\,t_{JC} + t_{JH} - 3\,t_{JF} = 0$
E	x	$10\,t_{EF} - 10\,t_{ED} - 10\,t_{EA} - 10\,t_{EG} = 0$
	y	$6.93\,t_{EB} + 8.66\,t_{EA} + 6.93\,t_{EH} + 8.66\,t_{EG} = 0$
	z	$4\,t_{EH} - 4\,t_{EB} + 5\,t_{EG} - 5\,t_{EA} = 0$
B	x	$10\,t_{BC} - 10\,t_{BA} - 10\,t_{BG} + 10\,t_{BF} = 0$
	y	$-6.93\,t_{BE} + 1.73\,t_{BA} + 1.73\,t_{BG} - 1.73\,t_{BC} - 6.93\,t_{BF} = 0$
	z	$8\,t_{BH} + 9\,t_{BG} + t_{BC} - t_{BA} + 4\,t_{BE} + 4\,t_{BF} = 0$
H	x	$10\,t_{HJ} - 10\,t_{HG} + 10\,t_{HC} + 10\,t_{HF} = 0$
	y	$1.73\,t_{HG} - 1.73\,t_{HJ} - 1.73\,t_{HC} - 6.93\,t_{HE} - 6.93\,t_{HF} = 0$
	z	$-8\,t_{HB} - 7\,t_{HC} - t_{HJ} + t_{HG} - 4\,t_{HF} - 4\,t_{HE} = 0$

These equations must now be solved. In the present instance, joint J is taken first, and Eq. *Jx* (Table I) for forces along the X-axis gives $t_{JH} = 0$. Substituting this value in Eq. *Jy*, we find t_{JF} to be -0.576, and then $t_{JC} = 0.288$ follows at once from Eq. *Jz*.

If joint C be now considered, it will be seen from Eq. *Cx* that $t_{CB} + t_{CH} = 0$ which can be substituted in Eq. *Cy* to obtain $t_{CF} = -1.15$. If we use this and the known value of t_{CJ} in Eq. *Cz*, an equation in t_{CH} and t_{CB} is obtained, which with Eq. *Cx* enables these two coefficients to be evaluated.

This process is continued until all the coefficients have been determined, and these, multiplied by the respective lengths of the members, give the loads in the members as listed in Table II.

TABLE II. LOADING OF VARIOUS MEMBERS AS COMPUTED BY METHOD OF TENSION COEFFICIENTS

MEMBER	TENSION CORFFICIENT t	LENGTH L	LOAD Lt
FC	−1.15	6.0	−6.9
FJ	−0.576	6.0	−3.46
FB	1.59	12.8	20.3
FE	−2.75	10.0	−27.5
FH	1.16	12.8	14.85
CB	−0.215	10.2	−2.19
CJ	0.288	6.0	1.73
CH	0.215	12.3	2.64
JH	0	10.2	0
EB	−1.194	8.0	−9.55
ED	−4.4	10.0	−44.0
EA	0.961	14.14	13.60
EG	0.684	14.14	9.7
EH	−0.86	8.0	−7.08
BA	1.28	10.2	13.06
BG	0.133	13.56	1.80
BH	−0.166	8.0	−1.328
HG	1.375	10.2	14.02

This method is of course equally applicable to a plane frame, in which case the equations involving the Z-axis are absent and the work is correspondingly simplified.

OUR READERS SAY—

In Comment on Papers, Society Affairs, and Related Professional Interests

Foundation Work for Morris Dam

To the Editor: In his article, "Construction of Morris Dam," in the September issue, Mr. Peugh has referred to the geological conditions at the dam site and the care taken in preparation. I can only emphasize his statements. Extreme care in the preparation of foundations for important dams has been the rule, particularly in recent years when certain failures have been attributed to foundation weakness. In no instance has greater care been exercised in this regard than for the Morris Dam. Throughout the construction of this dam no measures have been omitted where their inclusion might add to the safety of the structure. Before the dam was designed, most careful geological explorations were made, and the advice of competent geologists was sought. Before the state engineer's approval was secured, further geological studies were made. During the progress of construction, the field engineers' inspections and directions were supplemented by those of consulting engineers and geologists for the City of Pasadena and for the state.

As Mr. Peugh has noted, the rock underlying the dam site is characterized by a high degree of jointing. The planes of jointing range from very tight ones to some on which relatively small amounts of movement have occurred in remote times and in which brecciated material and gouging are found. These latter were specially treated to prevent seepage and to guard against the building up of hydrostatic pressures. The jointed formation had resulted in weathering which, in turn, required excavations deeper than would otherwise have been needed.

I wish to emphasize Mr. Peugh's remarks on the care exercised in excavating. Blasting was very strictly limited. All final trimming was done by the use of picks, bars, and wedges without the use of powder. The whole area was most thoroughly cleaned after all loosened blocks were removed.

The cut-off trench ranged in depth from 10 to 40 ft, and where shear planes were encountered they were plugged with concrete by filling shafts which were sunk from the cut-off trench to depths ranging, in one instance, up to 150 ft. As might be expected, all these operations took time. However, splendid cooperation was given by the contractors, and no details were slighted.

Paving the upstream face of the narrow ridge forming the west abutment with concrete was in itself a major operation. The efficiency of this paving for minimizing percolation has been fully demonstrated. When one considers the location of the reservoir formed by the Morris Dam, above a very populous area, the wisdom of the inclusion of added safety precautions such as this cannot be questioned.

Walter L. Huber, M. Am. Soc. C.E.
Consulting Engineer

San Francisco, Calif.
November 6, 1935

Cut-Off Trench—Left Abutment of Morris Dam

Morris Dam During Construction

Comments of Members on Membership Grades

In Response to Invitation for Constructive Suggestions Given in the November Issue

DEAR SIR: With reference to changes in membership grades, I would state that uniformity of grades and qualifications therefor should be secured by the four Founder Societies. These differences may be clear to all of us; but they are quite confusing to the layman who frequently needs to know how we are rated by our associates.

As faculty adviser for the last three years to both the civil and mechanical engineering student groups at Rhode Island State College, I have had an unusual opportunity to observe the effects of the two types of student membership. I am therefore forced to the conclusion that the grade of student member, not limited to any class except freshmen, would prove highly beneficial. We must consider the small as well as the larger colleges in this respect, the inclusion of sophomores increasing the number of prospective members so necessary to the proper functioning of a chapter. A combination rate covering badge, membership card, individual subscription to CIVIL ENGINEERING, and financial aid from the Society as long as membership is above an established minimum, would not only help the students but the Society and the profession.

CARROLL D. BILLMYER, Assoc. M. Am. Soc. C.E.
Assistant Professor of Engineering
Rhode Island State College

Kingston, R.I.
November 5, 1935

DEAR SIR: Your offer to the membership for a free and frank discussion of the membership change question is most welcome, but setting up the five questions as the only basis on which such discussions can take place seems to my mind to throttle the free expression of thought.

I instead would like to ask a few questions on my own: (1) By whom was the movement started for this change? (2) Why is it deemed necessary or advisable to revive it since it has been voted down?

I joined the Society as an Associate in 1922 and continued in that grade without any feeling of inferiority for 10 years until such time as a canvass of my elders in the profession showed that in their opinion I was worthy to be transferred to the grade of Member. I had not, nor do I have, any idea that such transfer made me the equal of all other Members. The outstanding members of our profession need no special designation to pick them out from the rank and file. Their various degrees, their writings, and the works with which their names are connected are in themselves distinguishing enough, and I feel sure that many of our leading Members feel the same way about it.

I feel that the way in which the amendment was submitted to vote was improper for the reason that it appealed to such Associate Members as felt that their title was belittling as well as to those Members who desired a further separation in the higher grade, thus leaving only a minority of something under 5,000 out of the total 14,946; and I think that we mustered quite a showing, all things considered! If the question must be kept alive, it is my thought that it should be done one step at a time; that is, by voting on the creating of a higher grade than that of Member. Following a decision on that question alone, then the question of abolition of Associate could be submitted, etc.

Personally I feel that the present set-up is all sufficient, and I have received many similar opinions from Members high in the ranks of the Society.

If you will accept this letter for publication I would appreciate it.

FRED L. MOORE, M. Am. Soc. C.E.

Hempstead, N.Y.
November 8, 1935

DEAR SIR: Please refer to the following portion of Section 11 under Amended Article II—Membership, of the proposed amendments to the constitution, which states that, "On and after November 15, 1937, transfer to the grade of Fellow shall be upon application—favorably endorsed by seven Fellows and approved. . . ."

For members resident in India, it will be impossible to get seven Fellows or even one Fellow to endorse. Some modifications of such a rule appears necessary in their case. I would suggest that their transfer to the grade of Fellow be made by not less than 80 per cent vote of the entire board without any limitation as to time; or that, as an alternative, those persons who are already Members under the present constitution should be allowed to become Fellows on application after five years of such membership.

B. L. MODAK, M. Am. Soc. C.E.
Chief Engineer, Holkar State

Indore, Central India
September 23, 1935

(Editor's Note: *This letter was written prior to the canvass of ballots on the amendments which took place on October 16.*)

DEAR SIR: Why should there be a higher grade of corporate membership in the Society? I have yet to hear or read a plausible answer to this question. It seems to me that the burden of proof lies with those who favor more than one grade.

If an amendment changing the designation Associate Member to Member and leaving the entrance requirements as they now are for Associate Member were proposed, it would probably receive the two-thirds vote required. The creation of a new and supposedly higher grade of membership called Fellow would again divide the membership and result in practically no change.

Coupling both changes in the proposal just voted upon, which left no choice but to take both or leave both, could not and did not result in a true expression of the wishes of the membership.

JOSEPH BARNETT, M. Am. Soc. C.E.
U. S. Bureau of Public Roads

Washington, D.C.
November 4, 1935

DEAR SIR: In the current issue I notice that the proposed amendment to the Constitution, relative to changes in membership grades, has failed.

Constructive comment being asked for, one thinks that reasonable opposition to change may be as constructive, and as conducive to the good of the Society, as new proposed changes.

During the eighteen years since I had the honor of being admitted, there have been several changes, and proposed changes; in my opinion, all for the worse.

Why not quit trying to remake the Society all the time to suit the ideas of first one bunch and then another?

The fairly ancient and entirely honorable title of Member of the American Society of Civil Engineers is good enough for me; I am proud of it and do not wish to see it degraded.

I will venture the opinion that the vast majority of Members do not want to see the title or requirements changed, and so voted. Also I think that the majority of the votes for the proposed change came from Associate Members, who of course would like to be advanced in name to the more desirable rating. It might even seem to a man on the side lines that some such division of voting was anticipated by those who engineered the proposition.

There is nothing to keep those who wish it from being as eminent and exclusive as they please, with any designation they choose to assume, in a society of their own; there is no good reason why they should be allowed to make over the American Society of Civil Engineers to achieve that end.

B. G. PASCO, M. Am. Soc. C. E.

Winnfield, La.
November 7, 1935

Additional Features of Los Angeles Harbor

TO THE EDITOR: Los Angeles harbor, which was described by Mr. FitzGerald in the September issue, is remarkable for its close proximity to the open sea and for the rapidity with which it has been developed and constructed within the past 10 or 15 years. It is purely an artificial harbor created by dredging and filling. The breakwater, which was built by Colonel Leeds, is an outstanding tribute to the design and method of construction. It stands in perfect condition today.

There is no question in the minds of those who live in Southern California that oil has been a prime factor in the construction of this harbor and the port of Long Beach. Today there are some 16,000 wells operating in California, the output from which can be raised to a million and a half barrels a day. The export value per annum is three times greater than that of the gold mined in the state.

Long Beach harbor, which is connected to Los Angeles harbor by the Cerritos channel, lies seven miles away in an easterly direction. The inner harbor at Long Beach has two channels, and the total water frontage is 37,700 lin ft, of which 34,400 ft, or 91.25 per cent, is privately owned. The publicly-owned water frontage covers 3,300 lin ft, or 8.75 per cent of the total. There is 9,460 lin ft of privately-owned developed water frontage and 1,735 ft of publicly-owned developed water front.

The outer harbor is not yet fully developed but has an existing potential frontage, which will be publicly owned, of 50,000 lin ft. The improved section now in use is 2,016 ft in length. This part of the harbor, which is protected by a breakwater 7,300 ft long, was completed on June 29, 1928. It cost $2,213,732 and is composed of rock amounting to 1,206,788 tons, which was put in place at a cost of $1.8344 per ton. The total capital expenditure on the harbor at the present time is $7,873,515. The depth of the inner and outer entrances is 32 ft at low tide. The preservation of the outer harbor was made possible by the building of the breakwater. The Los Angeles River now discharges immediately east of the breakwater and, during flood periods, carries down a large amount of silt and other debris. Before this breakwater was built the cost of maintaining clearance to the harbor was very great.

As mentioned in Mr. FitzGerald's paper, the land immediately abutting the Los Angeles harbor can be leased only for a period of ten years. This is a distinct disadvantage to prospective industries, since the investment of capital for the establishment of industry is retarded where the property cannot be owned outright. In this respect Long Beach has the advantage that the property immediately abutting the harbor is privately owned and is available for the building of industries.

Mr. FitzGerald refers to the asphalt-impregnated piles used in the development of Los Angeles harbor. The first piles were driven in 1922, and between that date and 1934 some 300,000 lin ft of these piles have been installed in Los Angeles and Richmond harbors, California. They have also been used in the construction of the U. S. Navy wharf at Melville, R.I., the Mission Bay bridge in California, and the Bellamy River bridge in New Hampshire. Recent inspections reveal all these piles to be in excellent condition and unaffected by sea action or frost. The piles used in the Bellamy River bridge in New Hampshire, were encased in pre-cast concrete slabs impregnated with asphalt for the vulnerable length exposed. The slabs were used as forms into which the concrete core was poured. This interesting form of concrete protection has been described by several engineers in various technical publications.

J. W. B. BLACKMAN, M. Am. Soc. C.E.
City Engineer-Director of Public Service
City of Long Beach

Long Beach, Calif.
November 9, 1935

The Port of Los Angeles—Long Beach

TO THE EDITOR: G. C. FitzGerald's excellent paper, in the September issue, covered his subject of the Port of Los Angeles so thoroughly as to leave slight field for comment.

The topography and hydrography of the Los Angeles area are such that Los Angeles and Long Beach harbors are in fact only artificial subdivisions of one great port. Only precedent, local pride, and jealousy are responsible for maintaining this artificial division and for the economic waste resulting from duplicate port administration.

The Greater Harbor Committee of 200 of the Los Angeles Chamber of Commerce, mentioned by Mr. FitzGerald, was organized because of the startling commercial growth of the harbor—from 5,000,000 tons to 27,000,000 tons between 1921 and 1923—and the lack of any adopted plan for future harbor development. The engineers chosen by this committee—W. K. Barnard and Charles T. Leeds, Members Am. Soc. C.E., and F. B. Cole, in cooperation with J. W. Ludlow, M. Am. Soc. C.E., the Los Angeles harbor engineer—prepared a comprehensive detailed plan. The Los Angeles part of the plan, with very minor modifications, is that shown by Mr. FitzGerald as the adopted future plan for the Los Angeles Harbor Commission.

The Greater Harbor Committee strongly urged uniting the two harbors into "a Port District comprising the entire region directly interested in the port, which should be administered by a Port Commission free from political influences. The form of control and operation should be such as to best serve the interests of all concerned therein." This was endorsed by the federal government.

The fact that the tidelands within Los Angeles harbor are almost entirely publicly owned, while a large part of those within Long Beach harbor are under private ownership, actually creates an advantageous situation. Some industries desire to locate only on land owned in fee, while others prefer to lease rather than to invest in land. In spite of much time and earnest effort, however, it has been found impossible to achieve an agreement between the cities of Los Angeles and Long Beach, although increasing commercial growth only emphasizes the economic waste incident to the inevitable destructive competition.

The economic survey authorized by the Los Angeles Harbor Commission, while Mr. FitzGerald was vice-president, was a very progressive step. The Economic Survey Board was composed of Dr. John Parke Young, economist, and four engineers. These were Carl C. Thomas, Member A.S.M.E., and Donald M. Baker, Ralph J. Reed, and Charles T. Leeds, all Members Am. Soc. C.E., under the chairmanship of the latter. Few American ports have made such a thorough economic analysis as a basis for administrative and fiscal policies.

Few ports, indeed, are self-supporting, and in many cases they should not be expected to be. The primary purpose of a port is not to produce profit but to serve the community and facilitate commercial development. A port renders indirect benefits to the community, such as the reduction of transportation costs, industrial development, and the increase of land values; and these benefits greatly outweigh the possible tax burden.

In almost all ports of this country, politics play too large a part. Port administration and management should be subject to no influences other than those conducive to the best development of the port. Hence, the port government should preferably be entirely separate from city, county, or state control.

Great Britain, the greatest of seafaring nations, affords instructive examples in port government. It has developed "The Public Trust" form of port authority, consisting of a separate municipal corporation with trustees representing the various interests. A suitable adaptation of this could advantageously be used in many ports of this country.

CHARLES T. LEEDS, M. Am. Soc. C.E.
Consulting Engineer

Los Angeles, Calif.
November 6, 1935

SOCIETY AFFAIRS

Official and Semi-Official

Annual Meeting Next Important Event on Society's Calendar

Six Technical Divisions Are Arranging Sessions; Many Social Functions Have Been Planned

ON JANUARY 15, 1936, the Eighty-Third Annual Meeting of the Society will open in New York. The program is rapidly taking form, and technical sessions have already been arranged by the City Planning, Highway, Construction, Sanitary Engineering, Structural, and Engineering-Economics and Finance Divisions. Dinners, entertainments, and inspection trips will round out the four-day schedule, and an excursion to Bermuda, beginning on the last day of the meeting, will make it possible for many members to continue the pleasant associations for another week.

The opening session of the meeting, on Wednesday morning, will be given over to business, to the awarding of medals and prizes for papers, the impressive ceremony of conferring honorary membership on four Members, and the introduction of the President-elect. In the afternoon there will be a general meeting to discuss reports of several committees of the Engineering-Economics and Finance Division—in particular, the report of the Committee on Principles to Control Government Expenditures for Public Works. In the evening there will be a dinner and dance at the Hotel Roosevelt.

Thursday, January 16, will be given over to meetings of the other Technical Divisions. The City Planning and Sanitary Engineering Divisions have each scheduled two sessions; the Highway, Construction, and Structural groups, one each. In the evening there is to be a smoker, for which some very unusual attractions are being prepared. Separate entertainment for the ladies is scheduled for the entire day, as well as for all other times during the meeting when the program events will not be of interest to them.

An all-day excursion is planned for Friday, open to both members and their ladies. Saturday will be given over to inspection trips to local points of engineering interest.

Throughout the week the customary college reunion dinners will be held, and the Sanitary Division, in conjunction with the New York State Sewage Works Association, has scheduled a special dinner for Tuesday evening, January 14.

And after the meeting, Bermuda! More or less of an experiment last year, this post-meeting feature met with such enthusiasm and was so well attended that it has been rescheduled without hesitation. Members, ladies, and guests will sail on Saturday afternoon, January 18, on the *Monarch of Bermuda*, and will arrive at Hamilton, Bermuda, on the morning of the 20th. In the following three days there will be opportunity for golf, fishing, hiking, and sight-seeing, or for any of a dozen other forms of sport or relaxation to suit the individual taste. The party will be back in New York Friday morning, January 24. A special all-expense price of $73.25 has been arranged for the round trip. This rate cannot be assured, however, after January 11, so an early decision will be to the advantage of anyone planning to make the trip. Reservations should be made through the office of the Secretary.

In the latter part of December an identification certificate making possible the purchase of round-trip rail transportation to New York at reduced rates will be mailed to the membership, together with an outline of the Meeting program. The final official program will appear in the January 1936 issue of CIVIL ENGINEERING.

The three days immediately preceding the Meeting—Sunday to Tuesday, January 12 to 14—will be taken up with meetings of the Board of Direction and its various committees. The annual past and present officers' dinner will be on Tuesday, January 14, at the Engineers' Club.

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NO FENDER-BUMPING IN BERMUDA

Autos Are Barred from the Islands, in Favor of Horses and Bicycles

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HAMILTON, BERMUDA, AS SEEN FROM SPITHEAD

Index for 1935 in This Issue

AT THE VERY END of this number will be found an index for the current Volume 5 of CIVIL ENGINEERING, covering the issues from January through December 1935. It will be noted that its 12 pages are well filled with information, covering completely the issues for the past year. A glance at the various headings will indicate the breadth of subject matter included in the 800-odd pages of text. The alphabetical list of authors comprises a select group who have been willing to offer worthwhile research, observations, or experience for the benefit of their fellow members.

To prepare any comprehensive index is a formidable task in itself. To have this material available so that it can appear in the December number, including all the papers and items of the issue in which it appears, is an even greater task. In spite of the obstacles, the Society has felt it a service due to members to make this index complete, and especially to make it available immediately. Libraries as well as engineers will appreciate the convenience and obvious advantages of this arrangement.

Also as a matter of convenience, the index has been included as a separate printed form. Thus by loosening the binding staples it may be removed intact and become available for filing or for binding in the yearly volume as desired. With this latter idea in mind, the first page of the index has been designed to make a title page for the bound volume.

Separate reprints of the index may be had from Headquarters at a cost of 15 cents a copy.

Society's Widespread Membership Aids a Young Engineer

LETTERS of introduction are a definite part of the Society's individual service to members. That they are immediately and directly effective is attested by many an appreciative note from members who have been helped.

A recent instance had to do with the travels of a Junior who graduated in June 1934, and had been unsuccessful in finding suitable employment in the East. He finally made contacts which promised a job in the Southwest. Through his Student Chapter he had learned that in the town to which he was going a welcome might best come from some Society member.

So he decided to call at Society Headquarters before departing. Here a note of introduction was prepared addressed to a member residing in the town in question, a man who had been very active in Society affairs and who was known to be particularly interested in young men and their problems.

Ten days later a letter was received from the Junior, in which the kindly reception accorded him was described as follows: "I am greatly indebted to you for giving me that letter of introduction to Mr. X. I arrived here a week ago as a total stranger, not knowing a single person in this city. Mr. X put me at my ease, made appointments for me, advised me whom to see, and gave me much needed advice and encouragement. He is one of the nicest and friendliest men that I have ever met and I feel indebted to you for the friendship I have already formed with him. I really would have been lost here if it were not for that friendly guiding hand."

He went on to say that when the position he had gone out to take was found to be wanting in some essential particulars, the older member steered him into several promising channels out of which came, indirectly, the securing of a satisfactory job—a result as much a surprise to the one as to the other.

Needless to say, this bit of kindness, coupled with good luck, established a bond of gratitude that will not easily be forgotten. However, it should be noted that the employment phase of this anecdote is entirely incidental. The regular channel provided by the Society for seeking employment is the Engineering Societies Employment Service.

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Manual of Engineering Practice No. 11

UNDER THE TITLE, "Letter Symbols and Glossary for Hydraulics, with Special Reference to Irrigation," another manual of engineering practice will be added to the growing list. This manual originated under the auspices of the Society's Special Committee on Irrigation Hydraulics, which was appointed by the Board of Direction on June 30, 1922. Beginning November 5, 1926, the Subcommittee on Nomenclature undertook "to outline and define suitable terms and symbols for the more important functions used in irrigation hydraulics with a view to their adoption as a standard avenue of expression." The first draft of this important work was prepared during 1927 and 1928, followed by Committee criticism, printing in PROCEEDINGS, and revision and repeated correction until finally it was deemed sufficiently authoritative to pass the rigid requirements for the Society's manuals of engineering practice.

In a very real sense the manual is the expression of preference by hydraulic engineers far and wide; but the excellent form and the selection, suggestion, and definition of content are to a large extent the work of J. C. Stevens, to whose unfailing perseverance, with the encouragement and active assistance of his fellow members, B. A. Etcheverry and Fred C. Scobey, must go the lion's share of the credit for making this much-needed work available.

As Manual No. 11, this valuable document is expected to be ready for mailing to every member of the Society some time during December 1935.

Medal and Prize Awarded

ANNOUNCEMENT IS MADE of the award of the Rudolph Hering Medal and the James Laurie Prize for 1934 papers appearing in Vol. 99 of TRANSACTIONS. The Rudolph Hering Medal goes to John H. Gregory, Orris Bonney, Robert A. Allton, and the late Robert H. Simpson, Members Am. Soc. C.E., for Paper No. 1887, entitled "Intercepting Storm Sewers and Stand-by Tanks at Columbus, Ohio." The James Laurie Prize goes to Wilson T. Ballard, M. Am. Soc. C.E., for Paper No. 1876, entitled "Three-Span Continuous-Truss Railroad Bridge, Cincinnati, Ohio."

Professional Records of Official Nominees

Notable Careers of Candidates for Society Offices Revealed in Brief Biographical Sketches

DANIEL WEBSTER MEAD

DANIEL WEBSTER MEAD was born in Fulton, N.Y., on March 6, 1862. He was graduated from Cornell University in 1884, with the degree of C.E. He was with the U. S. Geological Survey in 1884 and 1885; served as city engineer of Rockford, Ill., from 1885 to 1887; and was chief engineer and general manager of the Rockford Construction Company, from 1888 to 1896. Since 1896 he has acted as consulting engineer on hydraulic works and power plants. In 1904 he was appointed Professor of Hydraulic and Sanitary Engineering at the University of Wisconsin, holding this chair continuously for 28 years.

He has built water works for Rockford, Ill., Fort Worth, Tex., and other Western cities; filters for Moline, Danville, and Quincy, Ill.; hydro-electric plants at Kilbourn, Wis., at Prairie du Sac, Wis., and at many other places.

He is a member of the firms of Mead and Seastone, of Madison, Wis., and of Mead and Scheidenhelm, of New York City. He was a member of the Red Cross Commission to China, on flood protection of the Huai River, in 1914; and consulting engineer of the Miami Conservancy District from 1913 to 1920. In 1928 President Coolidge appointed him to the Colorado River Board to pass on the plans for the Boulder Canyon Project. At present he is a member of the board representing the federal government in connection with the construction work of the Chicago Sanitary District. He is a member of the American Society of Mechanical Engineers, the American Water Works Association, the New England Water Works Association, the American Institute of Consulting Engineers, the Wisconsin Engineering Society, and the American Association for the Advancement of Science, and holds the grade of Fellow in the American Institute of Electrical Engineers. At the time of his retirement from teaching in the University of Wisconsin, in 1932, he received the honorary degree of doctor of laws.

DANIEL WEBSTER MEAD
Nominee for President of the Society

Among his published works are: *Notes on Hydrology*, 1904; *Water Power Engineering*, 1908; *Contracts, Specifications, and Engineering Relations*, 1916; *Hydrology*, 1919. He has served the Society on a number of committees, notably those concerned with engineering education and Mississippi River flood control. In 1931, he was made an Honorary Member.

EDWARD P. LUPFER

EDWARD P. LUPFER was born October 22, 1868, in Blain, Pa. He graduated from the Newton (Kans.) High School in 1889. From the spring of 1889 to the fall of 1890, he was assistant engineer in charge of construction on the Denver and Rio Grande Western Railway in Utah. From 1890 until the fall of 1892, he served as assistant engineer of construction on the building of the Great Northern Railway from Havre, Mont., to the Pacific Coast.

EDWARD P. LUPFER
Nominee for Vice-President, Zone I

In 1892 he entered the University of Kansas, where he studied as a special student until 1894. From 1895 to 1897 he was assistant engineer of construction on the Denver and Rio Grande Western Railway in Southern Utah, and from 1897 to 1901 he held various positions on the Great Northern Railway, being division engineer of the Eastern Minnesota Railway in Minnesota from Deer River to Bemidji, in charge of 50 miles of construction during the year 1898; and locating engineer in the Columbia River and Okanogan country in the state of Washington in 1900.

From 1901 to 1903 he was resident engineer on the New York Central Railroad. During the next year he was locating engineer on the Buffalo and Susquehanna Railway, Wellsville to Buffalo; and from 1904 to 1907, he served as construction engineer on the Buffalo and Susquehanna Railway, in charge of all new construction from Wellsville to Buffalo. In the latter year he opened consulting and contracting engineering offices in Buffalo, N.Y., his company specializing in heavy construction work and bridges, both as consultants and contractors.

In 1925 he was appointed chief engineer in charge of the construction of the Peace Bridge across the Niagara River, at Buffalo. He is actively engaged in consulting engineering and construction work and is interested in many civic organizations in Buffalo and in New York state.

Mr. Lupfer is a former president of the Buffalo Section of the Society, a former director of the Chamber of Commerce of Buffalo, a director of the Buffalo Municipal Research Bureau, and a former president of the Buffalo Chapter of the Sons of the American Revolution. He is a registered professional engineer in the state of New York.

In April 1930 he was appointed a Director of District No. 3 of the Society to fill the vacancy caused by the death of George H. Norton. In 1931 he was elected Director of the district for a three-year term, expiring in January 1935. Thus his continuous service as a Director of the Society covered nearly five years. During that time he served for four years as a member of the Committee on Publications. Under the presidency of Harrison P. Eddy, he served one year on the Executive Committee.

HARRY W. DENNIS

HARRY W. DENNIS was born at Hornell, N.Y., on March 18, 1879. He was graduated from Cornell University in 1899, receiving a C.E. degree. His subprofessional work included surveys for the Erie Railroad in 1899; drafting in the office of Wallace C. Johnson, M. Am. Soc. C.E., consulting engineer, at Niagara Falls, N.Y., in 1899 and 1900; and surveys on the preliminary work for the New York State Barge Canal from May to September 1900. During the fall semester of 1900 he was an instructor in mechanics and hydraulics at Cornell University. From January 1901 to June 1904, and again from June to November 1905, he was draftsman and designer for the Niagara Falls Power Company and the Canadian Niagara Power Company at Niagara Falls, on structural steel and miscellaneous work in connection with the equipment in the wheel pits and power houses of the two companies.

During the year from 1904 to 1905 he was a leveler in the Department of the State Engineer of New York in charge of a survey party, his principal work being the securing of field data for the defense of the state of New York against extensive damage claims alleged to have been caused by the waters of the Erie Canal. From November 1905 to December 1909 he was in the employ of the late W. A. Brackenridge, M. Am. Soc. C.E., consulting engineer, on design and reports covering miscellaneous hydro-electric developments. During this period he served for one year as resident engineer in building a hydro-electric plant for the Wallkill River Company, at Walden, N.Y. In December 1909 he went to Los Angeles, Calif., where he entered the employ of the Southern California Edison Company as its construction engineer. He has continued in the employ of that company to date, and since July 1, 1926, has been its chief civil engineer.

HARRY W. DENNIS
Nominee for Vice-President, Zone IV

In 1924 Mr. Dennis became a member of the Committee on Arch Dam Investigation of the Engineering Foundation and was in charge of the construction of the Stevenson Creek Experimental Test Dam. He continued to be a member of this committee until the completion of the work and the discharge of the committee.

He joined the Society as an Associate Member in 1907, becoming a Member in 1914. He has been a member of the Los Angeles Section of the Society since its organization, serving as president in 1921. From 1927 to 1929 he was a Director of the Society, representing District No. 11.

CARLTON S. PROCTOR

CARLTON S. PROCTOR was born September 18, 1893, in Washington, D.C. He graduated from Princeton University in 1915, with the degree of C.E. Prior to entering college and during summer vacations he held a number of engineering positions. After graduation he was employed by McKenzie, Voorhees, and Gmelin in charge of foundations and structural steel. During the War he was a captain in the Construction Division of the U. S. Army in charge of construction for the War Department of various hospital and office buildings in Washington, Chicago, and St. Louis. After his discharge from the Army, he joined Daniel E. Moran in the formation of the firm of Moran, Maurice, and Proctor, consulting engineers, now Moran and Proctor.

CARLTON S. PROCTOR
Nominee for Director, District 1

His firm has served as consultant on the design and supervision of the foundations for such important structures as the Philadelphia–Camden Bridge, the Ambassador Bridge at Detroit, the Mid-Hudson Bridge, the Mississippi River bridges at Vicksburg and New Orleans, the St. Lawrence River Bridge at Lachine, and the San Francisco–Oakland Bay Bridge.

Moran and Proctor have acted as consulting engineers on numerous dams, power houses, and tunnels, including structures in Philadelphia, Washington, Boston, New York, and various other cities, and a large dam and navigation canal in Russia. They have also been retained on the design and construction of many important buildings in Cincinnati, Pittsburgh, Montreal, Detroit, Washington, Atlanta, St. Louis, Albany, and other cities in this country and abroad, one of the latter being the Palace of the Soviet in Moscow. On the list of such structures in New York City are the Federal Reserve

Bank Building, the Bank of Manhattan Building, the American Telephone and Telegraph Building, the Museum of the City of New York, the Bank of America Building, the New York County Court House, the New York Cotton Exchange, and many others.

Mr. Proctor has served as secretary, vice-president, and president of both the Princeton Engineering Association and the Princeton Alumni Association of Southern New York. He has been a member of the Graduate Council of Princeton University since 1920 and is chairman of the Education Committee of the Princeton School of Engineering. He was a member of the New York Building Congress NRA Committee, and vice-chairman of the New York City Code Compliance Committee. His clubs include the Princeton, Engineers, and Union League. He is active in Society affairs, being chairman of one of the committees of the Committee on Substructure Engineering and of the Code Committee. He is also a member of the Committee on Pile Driving Formulae and Tests.

He has contributed numerous engineering articles to technical publications and has addressed a large number of engineering societies, and is Brackett lecturer at Princeton University.

JAMES K. FINCH

JAMES K. FINCH was born December 1, 1883, at Peekskill, N.Y. He prepared at Trinity School, N.Y., for the Columbia School of Engineering, earning the degree of civil engineer in 1906. In 1911 he received a master's degree from the same institution.

JAMES K. FINCH
Nominee for Director, District 1

After serving for a short time as assistant engineer under E. deV. Tompkins and E. G. Carey, Members Am. Soc. C.E., on timber pier and foundation work in New York, he filled part of an academic year in 1907 as instructor in civil engineering at Lafayette College, Easton, Pa. From 1907 to 1909 he filled various engagements in the construction field. In 1910 he returned to Columbia University, where he is now completing his twenty-sixth year of service as an engineering teacher. During this period he has passed through the various grades of university appointment, having been instructor from 1910 to 1915; assistant professor from 1915 to 1917; associate professor from 1917 to 1927; and professor since 1927. In 1929 he was appointed Renwick Professor of Civil Engineering, the first appointment to a chair named in honor of Professor James Renwick (1790–1863), a pioneer American engineer and teacher. He is also executive head of the department.

During this quarter of a century, Professor Finch has devoted himself almost entirely to teaching and to the development of the work in civil engineering at Columbia. His summers have been spent largely at the university Summer School of Surveying, near Litchfield, Conn., where he has been director since 1914.

Professor Finch has represented the Society on the Federal Board of Surveys and Maps, and has contributed to Society publications. He has also presented papers on teaching problems at meetings of the Society for the Promotion of Engineering Education, of which he is a member. Although his early interests at Columbia were in surveying, structures, and construction, he has more recently been identified with the development of the teaching of hydraulics, especially in connection with recent advances in the field of fluid mechanics, and with working out a sequence of subjects in engineering economics which will encourage students to give greater attention to social and economic problems.

He initiated a brief course in the esthetic aspects of structural design, which is required of all civil engineering students at Columbia. He has published a number of papers on the history of engineering and, as a member of the Newcomen Society, has written for the *Transactions* of this British association.

Since 1934 Professor Finch has served as a Director of the Metropolitan Section of the Society. In 1927 he organized the Student Chapter at Columbia, of which he is faculty adviser. He is a member of the honorary societies of Sigma Xi and Tau Beta Pi, and his clubs include the Columbia University Club and the Century Association of New York.

C. E. MYERS

C. E. MYERS was born on January 31, 1888, and resided at McKeesport, Pa., during his childhood and youth. He graduated from the Pennsylvania Military College with the degree of civil engineer in 1909 and spent the following two years as instructor in civil engineering and military science and tactics at that institution. The following additional degrees were later conferred upon him by his alma mater: In 1924, bachelor of military science; in 1926, master of civil engineering; and in 1930, doctor of science. At the present time, he is a trustee of the college.

In 1911, he entered the employ of the Pennsylvania State Highway Department, where he served continuously until March 1921, with the exception of a year when he was furloughed to enter the military service. Beginning as a transitman, he passed successively through all grades to the position of district engineer, serving in that capacity in Washington, Pittsburgh, and Philadelphia. During the World War, he was a captain and major in the U. S. Engineer Corps, and at the present time is a lieutenant-colonel in the U. S. Reserves.

C. E. MYERS
Nominee for Director, District 4

Colonel Myers was in the service of the City of Philadelphia from 1921 to 1932, serving successively as engineer of construction and deputy chief of the Bureau of Highways, and director of the Department of City Transit. Since 1932, he has engaged in general consulting practice in Philadelphia. He is a registered professional engineer in Pennsylvania, New York, and New Jersey, and a member of the State Registration Board for Professional Engineers in Pennsylvania.

Colonel Myers is a former chairman of the Executive Committee, Highway Division of the Society, and a former director and former president of the Philadelphia Section. He is also an honorary member, former vice-president, and former president of the City Officials Division of the American Road Builders Association, and a member of the American Institute of Consulting Engineers, the Society of American Military Engineers, the American Society of Municipal Engineers, the Engineers Society of Pennsylvania, the American Concrete Institute, the Engineers Club of Philadelphia, and the Union League of Philadelphia.

RAYMOND A. HILL

RAYMOND A. HILL was born in Golden, Colo., on March 31, 1892, and spent his early life there, in Arizona, and in Michigan. He was graduated from the University

OFFICIAL NOMINEES FOR 1936

For President, Daniel W. Mead, of Madison, Wis.

For Vice-Presidents:

Zone I, Edward P. Lupfer, of Buffalo, N.Y.

Zone IV, Harry W. Dennis, of Los Angeles, Calif.

For Directors:

District 1, Carlton S. Proctor and James K. Finch, of New York (two to be elected)

District 4, C. E. Myers, of Philadelphia, Pa.

District 11, Raymond A. Hill, of Los Angeles, Calif.

District 14, L. I. Hidinger, of Memphis, Tenn.

District 15, E. P. Arneson, of San Antonio, Tex.

of Michigan in 1914 with the degree of bachelor of civil engineering. In 1922 he was awarded the degree of civil engineer by the same university.

Before entering college and during his undergraduate course he was with the U. S. Reclamation Service on the Strawberry Valley project in Utah, and following graduation was an engineering assistant in the same service in Colorado, Utah, and Arizona.

Commissioned in the Engineer Officers Reserve Corps prior to the War, he was called into active service in May 1917, and served in this country and overseas until August 1919. For a number of years subsequently, he was Captain, 316th Engineers, Reserve.

RAYMOND A. HILL
Nominee for Director, District 11

In September 1919 he entered the employ of the engineering firm of Quinton, Code and Hill of Los Angeles; three years later he became an associate and in 1926 was made a member of that firm. In May 1930 his firm consolidated with the firm of Leeds and Barnard, and since then he has been a member of Quinton, Code and Hill—Leeds and Barnard. It has fallen to his lot to handle for these firms much of their work in regions relatively remote from Los Angeles, including projects in Washington, Idaho, Arizona, New Mexico, Texas, and projects for both private and government interests in Mexico. In general, his practice has been largely in connection with hydraulic works, particularly irrigation and water supply, but has included rate and other economic studies for various communities.

At the present time he is engineering adviser to the United States section of the International Boundary Commission, United States and Mexico; consulting engineer to the Salt River Valley Water Users' Association in Arizona, which operates the Salt River Federal Reclamation Project; consulting engineer to the irrigation districts in New Mexico and Texas, which compose the Rio Grande Federal Reclamation Project; and consulting engineer to the cities of Oceanside and Santa Barbara, Calif.

He is a registered civil engineer in the state of California, and a registered professional engineer in both Arizona and New Mexico.

Mr. Hill served as president of the Los Angeles Section of the Society in 1926. He has always been active in the affairs of the Society, and at the present time is a member of its Committee on Meteorological Data. He is also a member of various other technical and social organizations and clubs.

LEROY LEMAYNE HIDINGER

LEROY LEMAYNE HIDINGER was born May 19, 1879, in Prescott, Iowa. He holds two degrees from Iowa State College, having won the degree of B.S. in C.E. in 1906 and that of C.E. in 1911. From 1904 to 1906 he served as county engineer of Boone County, Iowa, in which capacity he carried on drainage and reclamation work in connection with his college course. From the time of his graduation until June 1910 he was employed as drainage engineer by the U. S. Government. During this period he was in charge of projects in various states, chiefly river and flood control.

In 1910 he resigned from government service to enter private practice in Memphis, Tenn., as a partner with Arthur E. Morgan in the Morgan Engineering Company, which they had recently organized. He has since been continuously connected with this company—first as partner, then as vice-president, and for the past fifteen years as president. For the past twenty years he has been senior executive officer, and during the same period he has been associated with Mr. Morgan and others in the Dayton-Morgan Engineering Company.

His experience, which has been largely in connection with flood control and drainage, has also included highway and irrigation work. Among the major projects with which he has been connected the following may be mentioned: Little River Drainage District in Missouri, involving flood protection and drainage; reclamation of 500,000 acres of land in northeast Arkansas by flood protection; and the Wichita River project in Texas, including the construction of two dams and supplying water for the city of Wichita Falls, Tex. He was on the Trinity River project at Dallas for flood protection, and a member of the board of the Fifth Louisiana Levee District reporting on plans for the control of the Tensas and other rivers in that region. Mr. Hidinger has also been connected with the Lake Worth Drainage District in Florida for the drainage of a large area adjacent to the Everglades; the Miami Conservancy District in Ohio for the control of floods of the Miami and tributary rivers; and the Upper Scioto Conservancy District in Ohio for the control of floods.

LEROY LEMAYNE HIDINGER
Nominee for Director, District 14

He has been active in Society affairs, having served in 1920 and 1921 as a member of the committee that drafted the present constitution of the Society. He also served a four-year term on the Committee for Registration of Engineers at the time when it was most active in preparing a law that has in recent years served as a basis for registration laws enacted by many of the states. He is a former president and charter member of the Mid-South Section; a member of the Engineers' Club of Memphis; and a member of the American Institute of Consulting Engineers.

EDWIN P. ARNESON

EDWIN P. ARNESON was born in Fort Worth, Tex., on July 25, 1888. In 1910 he earned the degree of B.S. in C.E. at the Agricultural and Mechanical College of Texas, and in 1929 he received the degree of C.E. from the same institution. During the first year following his graduation he was employed by the Texas Company of Houston, Tex., on the design of warehouses, wharves, and similar structures, and from 1911 to 1913 he was office engineer for the Medina Irrigation Company of San Antonio, Tex., on surveys and the construction of a canal system. For the next year he was employed on various projects by the Ebro Irrigation and Power Company of Barcelona, Spain.

EDWIN P. ARNESON
Nominee for Director, District 15

From 1914 to 1915 he was in immediate charge of surveys and studies for a drainage project at Waco, Tex., and from 1915 to 1916 he was chief draftsman in the office of the city engineer of San Antonio, Tex., supervising the design of extensive municipal improvements. From December 1916 to March 1930, with the exception of a brief period spent in War service, he was a member of the civil engineering firm of Walton and Arneson, of San Antonio, engaged in topographic surveying and irrigation, highway, and structural projects. During the War he served in the Navy Department in the capacity of structural draftsman on the design of shipbuilding ways, crane runways, and waterfront improvements.

From March 1930 to date Mr. Arneson has been in private civil engineering practice, specializing in highway work. He is now director of Works Progress Administration, Texas District No. 10.

Mr. Arneson became a member of the Society in 1919. He has been active in the Texas Section, having served as president in 1932.

A Digest of Engineering Registration Laws

Extracts from Report Prepared for Engineers' Council for Professional Development

By P. H. DAGGETT

DEAN, COLLEGE OF ENGINEERING, RUTGERS UNIVERSITY, NEW BRUNSWICK, N.J.

THREE YEARS have elapsed since the last detailed analysis was made of engineering registration laws. Since that time the number of states having these laws on their statute books has increased 30 per cent, and nine of the laws have been amended. Engineering registration laws in one form or another are now in force in all but 13 states, 5 west of and 8 east of the Mississippi. In only two of these states, New Hampshire and Vermont, has there been no agitation for registration laws. (See map, Fig. 1.)

The object of this digest is threefold, (1) to provide engineers in a given state with the essential information regarding the requirements and cost of registration in any other state, (2) to serve as a guide for those promoting registration laws in states which do not now have them, and (3) to provide a comprehensive picture of the present status of the engineering registration movement (October 1935). In preparing the digest, the writer has had the assistance of T. Keith Legaré, M. Am. Soc. C.E., Secretary of the National Council of State Boards of Engineering Examiners.

Every effort has been made to present data, the accuracy of which may be relied upon. To this end some of the data, in particular some in Table II, have been verified by the secretaries of the several state boards, with the exception of those states in which laws were only recently passed. The data for Cols. 5 and 6 of Table III were obtained by means of a questionnaire sent to the secretaries. No replies were received from Mississippi and Tennessee, but the latest available figures indicate that the number of registered engineers in these two states is now less than five hundred. Allowing for multiple registrations, therefore, it is evident that the number of registered engineers at this time is not far from 35,000, although some 50,000 licenses have been granted since the registration movement started. As soon as the seven new boards complete their initial registrations, the number of registrants may be safely estimated at about 38,000.

The data in Col. 4 of Table III give the number of members in the five professional societies which are represented in the Engineers' Council for Professional Development, for which body the digest was originally prepared.

The following is a summary of the types of registration listed in Table I:

TYPES OF REGISTRATION	NO. OF STATES
Engineer (unclassified)	3
Engineer (classified)	1
Professional engineer (unclassified)	20
Professional engineer (classified)	6
Professional engineer (title protection)	1
Civil engineer	3
Structural engineer	1
Total	35

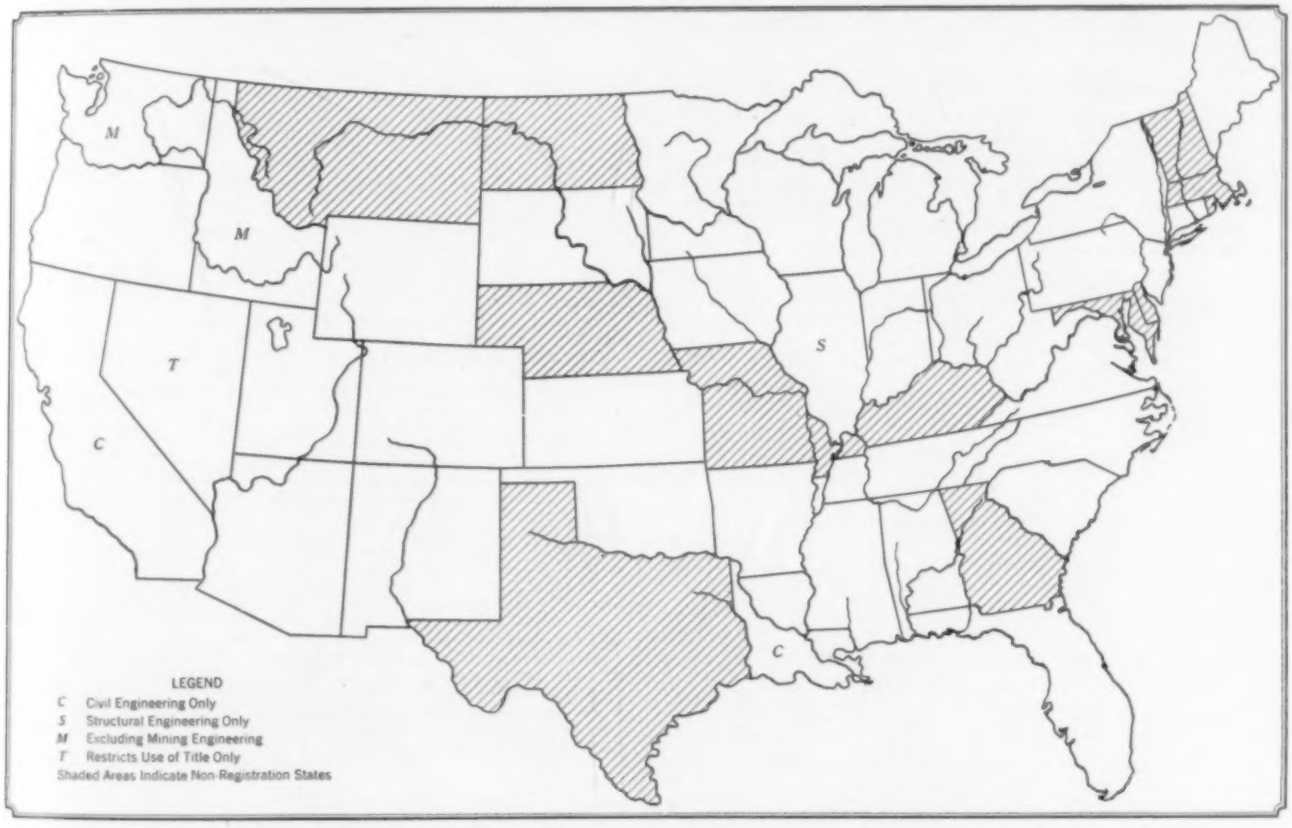


FIG. 1. MAP SHOWING STATUS OF ENGINEERING REGISTRATION AS OF SEPTEMBER 1935

EIGHTY-THIRD ANNUAL MEETING, January 15–18, 1936, in New York, N.Y., at Society Headquarters

TABLE I. ENACTMENTS AND SCOPE OF LAWS

(1) State	(2) Date of Enactment	(3) Amendments	(4) Type of Registration
Alabama	1935	.....	Professional Engr
Arizona	1921	'23, '28, '35	Professional Engr
Arkansas	1925	None	Professional Engr
California	1929	'31, '33, '35	Civil Engr (*a*)
Colorado	1919	'21, '27 (*b*)	Engr
Connecticut	1935	.....	Professional Engr
Florida	1917	'25, '31	Professional Engr (*c*)
Idaho	1919	'21, '25, '29	Civil Engr (*d*)
Illinois	1915	'19 (*e*)	Structural Engr
Indiana	1921	'35 (*f*)	Professional Engr
Iowa	1919	'24, '27, '31	Professional Engr (*g*)
Kansas	1931	None	Professional Engr (*h*)
Louisiana	1908	'14, '20 (*i*)	Civil Engr
Maine	1935	.....	Professional Engr
Michigan	1919	None	Engr (*j*)
Minnesota	1921	'33	Professional Engr
Mississippi	1928	'32	Professional Engr
Nevada	1919	.....	Professional Engr (*k*)
New Jersey	1921	'23, '26, '27	Professional Engr (*l*)
New Mexico	1935	.....	Professional Engr
New York	1920	'21, '27, '31, '32, '35	Professional Engr
North Carolina	1921	None	Engr
Ohio	1933	'33	Professional Engr (*m*)
Oklahoma	1935	.....	Professional Engr
Oregon	1919	'21, '25	Professional Engr
Pennsylvania	1921	'27 (*n*)	Professional Engr
South Carolina	1922	'28	Professional Engr
South Dakota	1925	None	Professional Engr
Tennessee	1921	'25	Engr
Utah	1935	.....	Professional Engr
Virginia	1920	'24	Professional Engr
Washington	1935	.....	Professional Engr (*o*)
West Virginia	1921	'31, '35	Professional Engr (*p*)
Wisconsin	1931	'35	Professional Engr
Wyoming	1907	'17, '19, '25	Professional Engr

TABLE II. REGISTRATION REQUIREMENTS

(1) State	(2) Age	(3) Citizenship	(4) Experience (Years) Non-Graduates	(5) Experience (Years) Graduates of Accredited Eng'g School
Alabama	..	.....	8	4
Arizona	25	.....	8	4
Arkansas	21	.....	4	2
California	25	.....	6	2
Colorado	25	.....	7	3
Connecticut	..	.....	8	4 (*a*)
Florida	21	.....	3	0
Idaho	21	.....	6	0
Illinois	21	.....	6	4
Indiana	..	U.S. or Canada	8	4
Iowa	25	.....	6	2
Kansas	25	.....	8 (*b*)	4 (*b*)
Louisiana	21	.....	0	0
Maine	35 (*c*)	.....	8	3
Michigan	21	U.S. (*d*)	6	2
Minnesota	25	U.S. or Canada	5	4
Mississippi	21	U.S. or Canada	6	1
Nevada	21	U.S.	0	0
New Jersey	21	U.S.	6	4
New Mexico	35 (*e*)	.....	8	4
New York	25	U.S. or Declaration	8	4
North Carolina	21	U.S.	10 (*f*)	4 (*f*)
Ohio	..	.....	8	4
Oklahoma	25	.....	8	3 (*g*)
Oregon	21	.....	6	2
Pennsylvania	21	U.S. or Canada (*h*)	10	2
South Carolina	21	U.S.	4	0
South Dakota	21	U.S.	6	2
Tennessee	..	.....	4	0
Utah	..	.....	8	4
Virginia	21	U.S.	4	0
Washington	..	State (*i*)	7	3
West Virginia	21	.....	7	3
Wisconsin	..	.....	7	3
Wyoming	25	U.S.	8	4
Model Law	..	.....	8	4

TABLE III. REGISTRATION STATISTICS

(1) State	(2) Population of State 1930 Census	(3) Engineers 1930 Census	(4) Engineering Society Membership	(4a) Am. Soc. C.E. Membership March 1, 1935	(5) Total No. Registered to July 1, 1935	(6) No. in Good Standing July 1, 1935
Alabama	2,646,248	2,155	251	104	...	...
Arizona	435,573	1,256	248	104	732	286
Arkansas	1,854,482	948	102	61	218	218
California	5,677,251	18,033	3,914	1,759	5,290	4,346
Colorado	1,035,791	1,456	689	267	500+	500
Connecticut	1,606,903	3,476	985	205	...	...
Florida	1,468,211	1,573	302	167	1,412	649
Idaho	445,032	341	144	47	361	174
Illinois	7,630,654	18,010	2,687	787	1,449	852
Indiana	3,238,503	1,666	589	124	2,471	1,492
Iowa	2,470,939	1,494	312	157	1,731	1,220
Kansas	1,880,999	1,231	284	139	266	260
Louisiana	2,101,593	1,276	329	170	1,002	502
Maine	797,423	911	143	50	...	...
Michigan	4,842,325	10,566	1,171	306	1,760	1,188
Minnesota	2,563,953	1,818	469	179	1,173	968
Mississippi	2,009,821	641	81	53	...	...
Nevada	91,058	395	114	33	...	...
New Jersey	4,041,334	16,512	2,386	570	3,303	2,263
New Mexico	423,317	513	111	49	...	...
New York	12,588,066	37,785	10,527	2,611	13,640	10,358
North Carolina	3,170,276	1,208	307	127	1,001	335
Ohio	6,646,697	14,492	2,216	596	3,200	3,200
Oklahoma	2,396,040	2,363	391	88	...	...
Oregon	953,786	1,395	338	172	1,720	784
Pennsylvania	9,631,350	19,221	4,711	1,171	5,436	3,507
South Carolina	1,738,765	636	118	65	411	143
South Dakota	692,849	224	84	23	376	225
Tennessee	2,616,556	1,559	437	235	...	...
Utah	507,847	1,149	269	61	...	...
Virginia	2,421,851	1,440	440	176	583	237
Washington	1,563,396	4,268	693	294	...	...
West Virginia	1,729,205	1,292	354	119	721	499
Wisconsin	2,939,006	2,909	695	143	678	656
Wyoming	225,565	244	68	25	219	219
Totals	97,082,665	174,456	37,129	11,237	(49,653)	(35,069)

NOTES TO ACCOMPANY TABLE I

(*a*) California: No person shall use the title "Structural Engineer" unless he is a registered civil engineer, and unless he is found qualified as such structural engineer according to the rules and regulations of the Board.

(*b*) Colorado: New law passed in 1927.

(*c*) Florida: Certificates read "Professional Engineer"—registered to practice . . . . (any one of the five branches, civil engineering, mechanical engineering, electrical engineering, mining and metallurgical engineering, and chemical engineering). Nine special fields are recognized in civil engineering, six in mechanical engineering, four in electrical engineering, and one in mining engineering.

(*d*) Idaho: Civil engineering is defined as the practice of any branch of the profession of engineering, other than mining, metallurgical, and military.

(*e*) Illinois: New law passed in 1919.

(*f*) Indiana: New law passed in 1935.

(*g*) Iowa: In the roster, registered engineers are classified into 21 branches of engineering; maximum of five for any one individual.

(*h*) Kansas: The law requires registration in a definite branch or branches of engineering. The policy of the board is to limit registration to a single branch in which the applicant is best qualified, or which most nearly covers his present field of practice. The law is permissive, not compulsory.

(*i*) Louisiana: New law passed in 1920.

(*j*) Michigan: The Board has the power to classify applicants into the respective branches of engineering, as follows: civil engineer, mining engineer, mechanical engineer, electrical engineer, chemical engineer, and such other branches of engineering as the Board may consider subject to the act.

(*k*) Nevada: The law is not compulsory. No person may use the title "Professional Engineer" unless registered.

(*l*) New Jersey: See note (*j*) under Michigan.

(*m*) Ohio: The Board is "authorized to designate the various branches of professional engineering and to classify the applicant in the branch or branches for which he is qualified to register."

(*n*) Pennsylvania: Original law declared unconstitutional and new law passed in 1927.

(*o*) Washington: Members of the American Institute of Mining and Metallurgical Engineers are exempted.

(*p*) West Virginia: The certificate authorizes the practice of "Professional Engineering" in the branch or branches of engineering for which, in the opinion of the Board, said applicant shows proper qualifications.

NOTES TO ACCOMPANY TABLE II

(*a*) Connecticut: "or passing an examination in engineering work of a character satisfactory to the board."

(h) Kansas: "The character, experience and training of the applicant shall in no case be less than that required for corporate membership in the A.S.C.E., A.S.M.E., A.I.E.E., and similar national engineering societies," interpreted as requiring 8 years practical experience of a character satisfactory to the Board, for which credit is given for time spent in an accredited engineering school. In effect this interpretation makes full distinction between graduates and non-graduates.

(c) Maine: Minimum age 35 years for registrants under the grandfather clause. No age requirement for regular registrants.

(d) Michigan: Residents of foreign countries may be registered "to engage as principals" in the practice of engineering "when they are recognized as consulting specialists in some branch of their profession and have had at least 10 years experience as such" or under conditions of reciprocity.

(e) New Mexico: Same as Maine.

(f) North Carolina: By a ruling of the Board. The minimum specified in the law is 5 years for non-graduates, and graduation from an accredited school is prima-facie evidence of qualification.

(g) Oklahoma: For graduates of engineering schools "of recognized high standing satisfactory to the Board."

(h) Pennsylvania: Citizens of foreign countries, who have practiced for more than 10 years, may be registered "at the discretion of the board."

(i) Washington: A registrant must be "a resident of this state or of a state, territory, or foreign country in which the requirements for the practice of the profession of engineering and/or land surveying are of a standard substantially equivalent to those of this act, and the state, territory, or country of his residence is authorized to grant equivalent reciprocal registration rights and privileges to registrants under this act."

Engineers Discuss Professional Recognition

UNITY in the approach to the problem of establishing adequate means for recognizing the engineer as a professional man is emphasized in the 1935 annual report of the Committee on Professional Recognition of the Engineers' Council for Professional Development, soon to be available in printed form, which attempts to clarify its position on the three avenues toward recognition that now exist—the legal sanction by professional registration, the professional degree of the engineering school, and admission to membership in one of the major engineering societies. Conrad N. Lauer, past-president, the American Society of Mechanical Engineers, is chairman of the Committee on Professional Recognition.

The report, which was adopted by the Engineers' Council for Professional Development, is part of its 1935 annual report. The Council is a conference of engineering bodies organized to enhance the professional status of the engineer through the cooperative support of those national organizations directly representing the professional, technical, educational and legislative phases of an engineer's life. The participating bodies comprising the Engineers' Council for Professional Development are the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Society for the Promotion of Engineering Education, the American Institute of Chemical Engineers, and the National Council of State Boards of Engineering Examiners.

The report of the Committee on Professional Recognition takes pains to repeat the statement contained in its 1934 report that the Engineers' Council for Professional Development is not setting itself up as a central examining body whose findings are binding on all bodies, but that it is rather a convenience whereby lack of uniformity in methods of professional recognition may be coordinated and standards raised.

Three avenues toward recognition now exist. The engineering schools provide limited recognition through varied processes of granting the professional degree. A second avenue is admission to the corporate membership of the large engineering societies. The only avenue for recognition having legal sanction is through professional registration. E.C.P.D. constitutes a deliberative and advisory body, the effort of which is to be influential in harmonizing the standards of these several agencies and bringing about a generally accepted concept of what may be termed the recognition of an engineer.

The objective such as is emphasized by E.C.P.D., says the report, admittedly is not immediately attainable. Before it can be established, certain basic elements should receive attention and be determined. These elements are: First, a program of post-collegiate training with emphasis upon the cultural and social aspects of the engineer's life as well as his training and experience in pure technique; second, the development of a standard by which to measure this post-collegiate attainment which will be adopted without further material question by the universities, by the boards of engineering examiners throughout the United States, and by the engineering societies.

The report emphasizes the fact that the registration of engineers is an important agency of recognition because it legally sets the standard for admission to the practice of the profession. Registration is operative in some form in 35 states and thus not only is, but must be acknowledged as, an established agency through which the professional status of an engineer will be recognized by himself, by the profession, and by the public. Furthermore, the registration is, for the engineer himself, of practical value, since it provides protection from those who would practice without qualification. It also provides prima facie evidence of individual capacity. However, it is pointed out that registration of engineers, as it exists in the various states, is not as yet sufficiently uniform to be fully satisfactory, as an analysis of the provisions of those state registration laws appended to the report clearly indicates.

The registration of engineers, the report says, is an important element in this unified approach toward the establishment of adequate means for recognizing the engineer as a professional man. E.C.P.D. should therefore, the report continues, address itself to rendering all possible assistance to effect uniform registration laws in states which now do not have them, to improving the registration laws where they now exist, and to effecting among those present laws a higher degree of uniformity as to requirements and as to form of recognition.

However, the report states, this is just a part of the work and, like other features, such as the granting of professional degrees and admission to corporate membership in the engineering societies, is a matter which cannot be achieved all at once. The Committee recognizes that a minimum standard for the granting of professional degrees is desirable but the granting of degrees is a charter responsibility of the colleges, and the granting of corporate membership in engineering societies is a matter of concern to their respective governing bodies, as related to the principles which hitherto they have felt to be of great value.

The report also points out that estimates will vary as to when either of these two procedures may be more universally recognized and accepted as harmonizing with the attainment of professional status, and much remains to be studied and evaluated before full attainment can be expected. While this is similarly true, it is said, of the time required to perfect the registration laws, there appears to be in them, however, a more immediate prospect of a unified approach and a uniform result. All assistance which E.C.P.D. can render therefore toward the engineering registration movement should be constantly and persistently applied.

In view of the fact that some important misunderstandings have arisen in connection with the program of certification adopted by E.C.P.D. in October 1934, and for other reasons, the Committee on Professional Recognition recommended that the program of certification be referred back to it for further study and clarification.

The report was accompanied by an appendix prepared by Dean Parker H. Daggett, of Rutgers College, analyzing the engineer registration laws of 35 states. An abstract of this report appears elsewhere in this issue.

Appointments of Society Representatives

F. W. GREEN and H. VON SCHRENK, Members Am. Soc. C.E., will represent the Society at the winter meeting of the American Society for the Advancement of Science, to be held in St. Louis, Mo., December 30, 1935, to January 4, 1936.

LESLIE G. HOLLERAN, M. Am. Soc. C.E., has been reappointed to represent the Society as an alternate on the Standards Council of the American Standards Association.

EDWIN W. JAMES, M. Am. Soc. C.E., represented the Society at the Seventh American Scientific Congress held in Mexico City from September 8 to 17, 1935.

ROBERT RIDGWAY, Hon. M. Am. Soc. C.E., represented the Society at the induction into office of C. C. WILLIAMS, M. Am. Soc. C.E., as president of Lehigh University.

E. R. NEEDLES, M. Am. Soc. C.E., has accepted an appointment to serve as a Society representative on the Engineers' Council for Professional Development for the three-year term, October 1935 to October 1938.

J. P. H. PERRY, M. Am. Soc. C.E., has accepted an appointment to represent the Society on United Engineering Trustees, Inc.

THADDEUS MERRIMAN, M. Am. Soc. C.E., has accepted a reappointment as the Society's representative on the Research Procedure Committee of the Engineering Foundation for the term, October 1935 to September 1936.

American Engineering Council

The Washington Embassy for Engineers, the National Representative of a Large Number of National, State, and Local Engineering Societies Located in 40 States

COUNCIL COMMITTEES HOLD MEETINGS

The Annual Assembly of American Engineering Council will be held in Washington on January 9, 10, and 11, 1936. Preliminary to this meeting, a conference of Council's public affairs committee was held in Washington, November 1. This committee, made up of the chairmen of major subcommittees of the public affairs committee, together with representatives of national and local societies, discussed several major public policies in which engineers have an opportunity for the expression of opinion.

The following subjects were included: administration of public works, development of aeronautics, competition of government with engineers in private practice, development of water resources, the trend in patent legislation, and the demand for rural electrification. Extensive discussion was given to various phases of these topics and approval was given to the development of complete reports on these subjects at the January meeting.

In line with Council's many actions on the basic federal survey and mapping program for the United States, it was voted that Council continue to work for a coordination of basic mapping activities and that such a mapping program should not be considered an emergency or relief measure, but a fundamental matter underlying any program of national planning.

Further discussion developed around the relation of engineers to national planning. It was generally agreed that many of Council's activities were themselves examples of the basic need, in the public interest, for a broader concept of national planning; that engineers by their training and experience, can make contributions to social and economic as well as to technical features of planning in its national as well as its state and local phases. The public affairs committee, as a committee of the whole, considered recommendations as to how this movement may best be forwarded for presentation at the annual meeting.

The public affairs committee recorded itself as in complete sympathy with the efforts of the National Civil Service Reform League to establish a wider public understanding of the essential value of the merit system. It was recommended that the staff of Council cooperate with local and national engineering bodies to support the development and protection of the merit system as the only sound basis for improvement in the technical services of the government.

It was proposed to take steps to coordinate further the work of the national public affairs committee with the state and local public affairs committees in order that the Council, in all matters, be truly representative as a complete cross section of the profession.

At the meeting of the executive committee of American Engineering Council, held November 2 in Washington, the nominating committee consisting of A. W. Berresford, Chairman, H. P. Eddy of Boston, and Robert W. Yarnall of Philadelphia, unanimously reported the selection of Dean Andrey A. Potter as nominee for the presidency of American Engineering Council for 1936–1937. Dr. Potter is Dean of the Schools of Engineering, Purdue University.

Council's membership continues to expand. When the new membership plan of nominal dues to state and local societies was adopted last January, sixteen such societies were members. Now the number is more than double and active steps toward joining are being taken by several others.

Washington, D.C.
November 11, 1935

Valuable Papers Filed for Reference

IN THE DECEMBER 1933 issue of CIVIL ENGINEERING appeared a list of papers recently placed for reference in the Engineering Societies Library. Since that time several other papers containing much of interest and value to the profession have been similarly filed by permission of the authors. Résumés of some of these papers follow. The originals can be examined at the Library, 29 West 39th Street, New York, N.Y., and estimates of the cost of photostatic copies will be given by that organization on request.

CAR CLEARANCE TABLES

ANDERS BULL, M. Am. Soc. C.E., "Car Clearance Tables" (about 4,000 words of text plus 3 sheets of diagrams and 5 sheets of tables). The paper explains the method used in the engineering department of the Board of Transportation, City of New York, for computing excess clearance required for railway cars on circular, compound, and reverse curves, and transition spirals. As compared to the conventional method of plotting and scaling, the method described has the advantage of greater convenience and accuracy. Formulas are derived covering center excess and end excess at any point of a curve and its approach, and it is shown how the values obtained may be arranged in tables from which the amount of the excess is found to the nearest tenth of an inch by a single slide-rule division. Formulas covering superelevation excess for various conditions are likewise given, and the use of the tables is illustrated by typical examples.

EMPIRICAL RUN-OFF FORMULAS

FRANCIS BATES, M. Am. Soc. C.E., "Empirical Run-Off Formulas" (about 7,000 words of text plus appendices, including 7,000 words of description, 16 sheets of tables, and 50 sheets of sample computations). Using present-day theory, Mr. Bates reconstructs the earlier exponential equations for run-off, still widely used. Thus theory is harmonized with the original interpretations of the observed data on which the empirical formulas were based. This tends to substantiate the theory as well as to provide a means for intelligently using the empirical formulas. Definite information is given, showing (1) the proper selection of formula; (2) the base value of the coefficient, C', for each; and (3) the ratios to be applied to these base values, in order to adjust the C' factor to prevailing conditions. The various determinations are tied in with modern practice, so as to present the information in the most useful form.

THE SKYSCRAPER

DR. ROBINS FLEMING, "The Skyscraper" (about 35,000 words). Painstaking research is evidenced by the thoroughness in studying available literature on the skyscraper, including its origin, development, extent and distribution, and expected life. Interesting chapters are entitled "The Battles of the Skyscraper" and "The Skyscraper of the Future." Extracts of part of this paper have already appeared in CIVIL ENGINEERING in the October and December 1934, and June 1935 issues. The intensive character of Dr. Fleming's study is indicated by his generous annotation.

STEEL WHARVES—DESIGN AND CONSTRUCTION DETAILS

RAYMOND P. PENNOYER, Assoc. M. Am. Soc. C.E., "Steel Wharves—Design and Construction Details" (about 15,000 words plus 63 figures, mostly large-scale photographs). Various types of steel wharves are considered, together with their loading, stresses, and engineering details. There are many photographs of actual structures and much information on their history. Originally presented before the Engineers Society of Wisconsin, February 1933, parts of this paper have been abstracted by the author into articles issued in the November 1933, April 1934, June 1934, and January 1935 issues of CIVIL ENGINEERING. The complete paper offers a wealth of material, supplementary to the published articles. Questions of cost are not covered.

Preview of Proceedings

By HAROLD T. LARSEN, *Editor*

Sedimentation, stilling basins, turbulence, design of reinforced concrete members, wind stresses, arch bridges, slope deflection, water conservation, irrigation—these are the branches of engineering that will be made richer by the papers (and their subsequent discussions) offered in the December "Proceedings."

SEDIMENTATION IN QUIET AND TURBULENT BASINS

Studies to determine the characteristic rates of settlement of suspended particles in quiet and turbulent water are described in a paper entitled "Sedimentation in Quiet and Turbulent Basins" by J. J. Slade, Jr., which has been scheduled for the December issue of PROCEEDINGS. It is pointed out that rates of settlement introduced by the late Allen Hazen, M. Am. Soc. C.E., were derived for a particle of sediment and that their application to the entire material can be justified only when their assumed value satisfies the conditions actually existing in the basin under study. In other words, for sediment in which the particles have a constant hydraulic value in a completely turbulent basin, the Hazen theory is complete.

In his paper, Professor Slade attempts to supplement and extend Hazen's work to take into account the variation in hydraulic value as well as the variation in degree of turbulence that may occur in a basin. The formulas given in the paper may be generalized to any desired degree. In other words, only practicability need limit the number of constants entering into them. Professor Slade introduces three classes of constants: (1) Those that denote the characteristics of the sediment, (2) those that express the characteristics of the settling basin, and (3) those that express the degree of agitation involved.

REINFORCED CONCRETE MEMBERS WITH DIRECT TENSION AND BENDING

In a forthcoming paper entitled "Reinforced Concrete Members with Direct Tension and Bending," D. B. Gumensky, Assoc. M. Am. Soc. C.E., offers a proposal for simplifying the practical design of such members. Beginning with the customary assumptions pertaining to reinforced concrete design, Mr. Gumensky develops the elementary formulas necessary and defines two distinct cases of stress distribution under the heading of his paper. The first case is that in which the entire section is under tension; and the second case is that in which part of the section is under compression. The declared value of this paper lies not so much in its analytical phases as in the nature of the curves presented for their rapid and easy solution.

A full appreciation of the advantages of the procedure outlined by the author can be obtained only by using in practice the complete set of curves upon which the arguments of the paper are based. The paper is offered in a greatly condensed form, however, with sufficient curves to demonstrate the principles involved. It is hoped that discussion will develop the inherent value of such curves as design tools in an engineer office, so that when the opportunity arises such complete curves, corrected and enlarged or further condensed in accordance with the suggestions offered in discussion, may be made available in one form or another.

SUCCESSIVE ELIMINATION OF UNKNOWNS IN THE SLOPE–DEFLECTION METHOD

In "Successive Elimination of Unknowns in the Slope-Deflection Method," the shortest and most concise technical paper that has appeared in PROCEEDINGS for many years, John B. Wilbur, Assoc. M. Am. Soc. C.E., offers a new slant to the application of the slope-deflection method in the solution of statically indeterminate structures by the successive elimination of unknowns. Although it may be said that adaptations of this nature are such as might be "discovered" by a designer in applying a commonly known method of structural analysis, the fact remains that the technic described by Dr. Wilbur is essentially novel and worthy of study. The paper is clear and logical and, above all, well written, simple, and direct.

WIND STRESSES IN REINFORCED CONCRETE ARCH BRIDGES

"Wind Stresses in Reinforced Concrete Arch Bridges" is the title of a paper by A. A. Eremin, Assoc. M. Am. Soc. C.E., to be offered to readers of PROCEEDINGS in December. In treating the subject of wind stresses, Mr. Eremin, in a scant dozen pages, develops his subject in an interesting manner. His paper includes the analysis of an arch rib without bracing as well as the effect of lateral cross-bracing. An illustrative example provides material aid in interpreting the theory propounded.

CONSERVATION OF WATER

The Committee of the Irrigation Division on the Conservation of Water, which was created in 1929, has worked steadily on a well-defined program of study. Its first Progress Report, now being prepared for inclusion in the December issue of PROCEEDINGS, will offer a statement of the basic problems involved and suggestions for their solution. Discussion on this report will appear in succeeding numbers of PROCEEDINGS.

News of Local Sections

ALABAMA SECTION

A meeting of the Alabama Section was held in the Thomas Jefferson Hotel in Birmingham on October 14, with W. H. Caruthers, president of the Section, in the chair. There were 19 present. During this session Mr. Caruthers was elected a delegate to the Fall Meeting in Birmingham, and J. H. Mayer was elected director to fill the unexpired term caused by the resignation of William M. Woodbury. A resolution appointing a committee of three to act for the Section, in conjunction with representatives from other engineering societies, in carrying out the provisions of the recently created state Board of Registration for Professional Engineers and Land Surveyors, was unanimously adopted.

CENTRAL OHIO SECTION

There were 30 members and guests present at a luncheon meeting of the Central Ohio Section held in Columbus on September 19. A brief outline of the regional meeting to be held in Zanesville was given by Edward L. Winslow, Jr., assistant engineer, Corps of Engineers, U. S. Army. The speaker of the occasion was E. F. Coddington, of Ohio State University, who gave a talk on "The Use of Geodetic Surveys to Control Boundary Surveys."

COLORADO SECTION

The 242d meeting of the Colorado Section was held at the Olin Hotel in Denver on September 9. There were 44 present at the dinner, and 25 additional members in attendance at the meeting following it. The first speaker on the program was A. K. Vickery, city engineer of Denver, who discussed the topic of street construction in Denver. C. D. Vail, state highway engineer of Denver, Colo., then spoke on the financial status of the highway department. The final talk was given by Roy A. Klein, senior highway design engineer in the U. S. Bureau of Public Roads, who outlined the history of the Bureau. Interesting pictures were shown in connection with this talk, and an informal discussion of the topics treated during the evening concluded the program. The 243d meeting of the Section was held on October 14, with 47 members and guests present at the dinner and 17 additional members in attendance at the meeting following dinner. On the list of speakers were Clarence Rawhouser and R. P. LeVaron, both of the U. S. Bureau of Reclamation. Mr. Rawhouser described methods of determining and controlling the temperature and steam in mass concrete, and Mr. LeVaron gave a talk on the design of welded structures.

The ninth regular meeting of the Association of Junior Engineers of the Colorado Section was held on October 7, with 23 present. Most of the session was devoted to discussion of the different programs to be presented at the meetings held during the year. A motion was made and carried that the meetings be held on the fourth Monday of the month.

DAYTON SECTION

The October session of the Dayton Section took the form of a luncheon meeting held at the Engineers' Club on October 21. An interesting talk was given by John S. Moore, who for several years has been a representative on the League of Nations Association, on the industrial development of Japan, China, and Manchuria. There were 16 present. At a meeting of the Section held on November 18, the report of the Nominating Committee was presented, and a talk on "Interesting Features of Modern Dam Construction" was given by Charles H. Paul, one of the country's foremost consultants on dams and flood-control problems. There were 26 in attendance.

DISTRICT OF COLUMBIA SECTION

On November 12 the District of Columbia Section held a meeting for the discussion of Section and Society Affairs. This discussion was led by F. M. Feiker, executive secretary of American Engineering Council; W. H. Richards, Section delegate to the Local Section Conference at Birmingham, Ala.; John H. Gregory, former Director of the Society; D. H. Sawyer, Vice-President of the Society; and Herman Stabler, Director of the Society. There were 100 present.

FLORIDA SECTION

There were 16 members and guests present at a meeting of the Florida Section held on October 26 at the University of Florida, in Gainesville. After the meeting was called to order by Percy L. Reed, president of the Section, R. M. Angas, Section delegate to the Fall Meeting of the Society, gave a report on the Local Sections conference held at that time. After the meeting many of the members joined in the annual home-coming alumni luncheon of the University of Florida, and in the afternoon witnessed a football game.

GEORGIA SECTION

A meeting of the Georgia Section was held in Atlanta on November 11, with 14 present. During the business session the following officers were elected for the coming year: M. T. Singleton, president; J. W. Barnett, vice-president; and J. B. Trenholm, nonresident vice-president. F. H. McDonald, Director of the Society, spoke on some aspects of the meeting of the Board of Direction held at the time of the Fall Meeting. The speaker of the occasion was M. T. Singleton, consulting engineer of Atlanta, whose topic was "Sewage Disposal Program for Atlanta." In this talk, which was illustrated by an interesting selection of slides, Mr. Singleton brought out the fact that several disposal plants would be necessary because Atlanta is located on several different watersheds. An interesting discussion, led by W. A. Hansell, followed.

ITHACA SECTION

The annual dinner meeting of the Ithaca Section, held in Willard Straight Hall on the campus of Cornell University on October 17, was the occasion for the election of officers for the coming year. Results of the election were as follows: H. E. Snyder, president; C. A. Harrell, first vice-president; S. C. Hollister, second vice-president; and J. E. Perry, secretary-treasurer. The guest speaker was R. E. Treman, of Ithaca, who gave an illustrated talk on "Big Game Hunting in the Rockies."

KANSAS CITY (MO.) SECTION

On October 14 the Kansas City (Mo.) Section held a meeting at the Newbern Hotel, which was attended by 45 members and guests. Maurice Allendoerfer gave a brief talk on a charities' campaign soon to open. He was followed on the program by E. H. Connor, vice-president and chief engineer of the Missouri Valley Bridge and Iron Company, who spoke on the subject of substructure construction for the Oakland Bay Bridge. His talk was illustrated with four films of motion pictures.

METROPOLITAN SECTION

The little-publicized but highly important work of the civil engineer in the U. S. Navy was described by Admiral R. E. Bakenhus at a meeting of the Metropolitan Section held in New York City on November 20. A Navy film showing fleet maneuvers and slides depicting civil engineering features of Navy work illustrated the address. Admiral Bakenhus discussed the experience of the Navy with the use of timber and concrete in dry docks. Considerable trouble has been encountered with the latter material. The walls of dry docks are subject to constant attack by salt water from the back side, and during the long periods when the dock is unwatered, evaporation from the dry face induces a continuous penetration of salt solution whose solid residue gradually disintegrates the structure. In recent reconstruction this danger is being combated by the use of extremely dense concrete and a layer of waterproofing. The address was discussed by Commander W. M. Angas, who reviewed the research work of the Civil Engineer Corps on verification of pile-driving formulas, on concrete design and construction, and on wind stresses. In a second discussion, L. Alfred Jenny recounted personal experiences in the construction of floating dry docks. More than 400 persons attended the meeting.

During November the Junior Branch of the Metropolitan Section held two meetings. On November 12 they were addressed by L. W. Weed, of the Portland Cement Association, who showed a film depicting the manufacture of cement and stimulated a lively discussion on the proper methods of use of concrete. The subject considered at the November 26 meeting was the relation between engineering and architecture. An illustrated lecture was given by James K. Finch, Renwick Professor of Civil Engineering at Columbia University.

NORTHWESTERN SECTION

The Northwestern Section of the Society held its annual meeting at the Campus Club of the University of Minnesota on the evening of November 7, following a dinner. There were about 75 members and guests present. The meeting was given over principally to a discussion of the topic, "Models of Sand Dams for the Mississippi River Development," presented by Hibbert Hill, senior engineer in the U. S. Engineer Office in St. Paul, and Lorenz G. Straub, professor of hydraulics at the University of Minnesota. During the business session the following officers were elected for the coming year: O. M. Leland, president; H. K. Dougan, first vice-president; Lorenz G. Straub, second vice-president; and A. J. Duvall, secretary-treasurer.

PHILADELPHIA SECTION

A capacity audience was present at the Philadelphia Section's second meeting of the year, held on November 20, when William H. Ellis, engineer of erection for the Phoenix Bridge Company, presented a paper describing the salient features of the construction of the Buzzard's Bay Bridge over the Cape Cod Canal. Slides made a fine addition to a clear presentation of the obstacles that were encountered in the erection of this 544-ft vertical-lift span, the longest bridge of its type in the world. The discussion was led by W. H. Chorlton, professor of structural engineering at the University of Pennsylvania, who illustrated the development of the tower design. C. P. Schantz brought out several interesting features of the cable lift, sheave, and counterweight design. J. G. Shryock made able comparison with the first important vertical-lift span, constructed by J. A. L. Waddell in Chicago in 1892, with a span of 130 ft and a lift of 140 ft. S. H. Yorks presented the sound film showing the manufacture of structural steel by the Bethlehem Steel Company. This film gave a graphic picture of the processes from the unloading of the ore at the dock, showing the blast furnaces and open hearths, the ingot molds, and the rolling sequence of structural shapes, plates, and rods. Lester L. Lessig, contracting engineer of the McClintic-Marshall Corporation, in the capacity of chairman of the meeting welcomed 113 members and guests to dinner and 210 to the meeting.

PORTLAND (ORE.) SECTION

There were 38 present at a meeting of the Portland (Ore.) Section held at the University Club on October 18. During the business session J. C. Stevens gave a progress report of the committee for the 1936 Annual Convention. Then G. W. Holcomb, assistant professor of civil engineering at Oregon State Agricultural College, discussed the activities of the Engineers' Council for Professional Development, and Mr. Stevens supplemented his talk by explaining the purpose of E.C.P.D. The technical program consisted of interesting talks by R. H. Baldock, state highway engineer, and G. S. Paxson, assistant bridge engineer in the Oregon State Highway Commission. Mr. Baldock spoke on "The Oregon State Highway Program," and Mr. Paxson discussed both the Coos Bay and the Alsea Bay highway bridges now under construction.

ST. LOUIS SECTION

The 226th meeting of the St. Louis Section was held at the York Hotel on October 28, with 31 members and guests present. R. B. Brooks, member of the Section and United States delegate to the Second International Congress of Public Cleansing held at Frankfurt-am-Main, Germany, August 19–23, 1935, gave a most interesting talk on his experiences in Central Europe. Mr. Brooks had an unusual opportunity, through his official connections, to make first-hand observations of engineering, political, and economic conditions, and his talk was greatly appreciated by members of the Section.

TACOMA SECTION

A dinner meeting of the Tacoma Section was held on November 4, with 66 members and guests in attendance. During the business session the annual election of officers was held, with the following results: J. P. Hart, president; O. H. Halberg, vice-president; G. M. Thayer, secretary-treasurer; and Fred Dunham, director. Mr. Hart, who is a member of the newly appointed Engineers' Examining Board for the State of Washington, spoke of the organization of the board. The first guest speaker was F. E. Banker, director of the Department of Conservation and Development of the State of Washington, who discussed the preliminary work done in connection with the construction of the Grand Coulee Project. He was followed by A. F. Darland, field engineer for the U. S. Bureau of Reclamation, who gave an interesting and detailed description of progress made on the project to date. His talk was illustrated with slides.

VIRGINIA SECTION

The fall meeting of the Virginia Section was held at the Virginia Military Institute in Lexington, Va., on October 12. There was an attendance of about fifty members and guests, in addition to engineering students from the Virginia Military Institute and Washington and Lee University. After the business meeting Col. William Hunley, of Virginia Military Institute, welcomed the visitors, and W. D. Tyler, president of the Section, responded. W. R. Glidden, bridge engineer for the Virginia State Department of Highways, presented a paper on "The Design and Construction of the New North River Bridge at Lexington." Cadets Douglas and Royce gave short talks on the history, design, and construction of the old North River Bridge. Then an interesting illustrated lecture on the manufacture of steel was presented by A. E. Crockett, of the Jones and Laughlin Steel Corporation. After luncheon at the officers' mess, at which all were guests of the Virginia Military Institute Student Chapter, a review of the Cadet Corps was held on the parade ground. In the afternoon some of the visitors viewed the new bridge and other points of interest in the vicinity of Lexington, while others attended a football game.

Student Chapter Notes

SWARTHMORE COLLEGE

The most important activity of the past school year for the Swarthmore College Student Chapter was the sponsoring of the annual convention of Student Chapters of the Philadelphia district. In all, 96 visitors were entertained at this convention, which attracted a total attendance of 151. After a day devoted to the presentation of interesting technical papers, members of the Chapter and their guests journeyed to Philadelphia, where they attended a dinner meeting of the Philadelphia Section. Another highlight of the school year was the annual open house for which the Chapter arranged many engineering exhibits. Students furnished the programs for all 21 meetings held during the year.

SYRACUSE UNIVERSITY

A full enrolment of those eligible for membership in the Syracuse University Student Chapter is reported for the past year. There were twelve meetings at which entertainment consisted of talks given by faculty members and outside speakers and the showing of the Society's illustrated lectures. Of special interest were the inspection trips made during the year to numerous points of engineering interest, including the hydro-electric plants on the Beaver River in the Adirondacks; power plants at Niagara Falls, N.Y., and Ontario, Canada; sewage- and garbage-disposal plants in Syracuse; and local bridges.

UNIVERSITY OF TENNESSEE

Members of the University of Tennessee Student Chapter participated in various activities during the 1934–1935 school year. They attended the joint meeting of the Tennessee Valley and Mid-South Sections held in Knoxville on November 8, 9, and 10, and in December they made an inspection tour of Norris Dam. The Chapter has cooperated in the issuance of the *American Collegiate Engineers*, a pamphlet that represents the work of all the engineering students on the campus. Eight regular meetings, with a total attendance of 144, were held.

TEXAS TECHNOLOGICAL COLLEGE

In addition to eight regular meetings, the Texas Technological College Student Chapter was engaged in several outside activities of interest during the past school year. Chief among these were the annual engineering show, held on April 5 and 6, and the annual banquet given on April 18 in honor of J. A. Focht, president of the Texas Section of the Society. The Chapter was also responsible for the writing and editing of a page in *La Ventana*, the college yearbook.

UTAH STATE AGRICULTURAL COLLEGE

The newly formed Utah State Agricultural College Student Chapter held 12 meetings, with a total attendance of 727, during the past year. Most of these sessions were devoted to the discussion of various business matters. In the spring an engineers' banquet was held.

VANDERBILT UNIVERSITY

Vanderbilt University Student Chapter reports 100 per cent enrolment during the past school year of those eligible for membership in the Chapter. In addition to eight regular meetings, the Chapter sponsored two smokers. The speakers on these occasions were James Stahlman, publisher of *The Nashville Banner*, and Martin Roberts, contracting engineer.

VILLANOVA COLLEGE

Of the 22 meetings held by the Villanova College Student Chapter during the past year, six were joint meetings with the Villanova branches of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers. At these sessions the chief form of entertainment was the presentation of student papers and the showing of the Society's illustrated lectures. There was complete enrolment of those eligible for membership.

VIRGINIA MILITARY INSTITUTE

Students played an unusually active part in providing technical programs for the 20 meetings of the Virginia Military Institute Student Chapter held during the recently completed school year. The Chapter also made good use of the Society's illustrated lectures, heard seven outside speakers, and made five inspection trips to industrial and construction projects in Virginia and West Virginia. In the spring the Chapter was host to a Student Chapter convention, at which guests were present from Virginia Polytechnic Institute, the University of Virginia, and Washington and Lee University. There was 100 per cent enrolment of those eligible for membership.

UNIVERSITY OF WASHINGTON

An unusual number of interesting field trips were enjoyed by the University of Washington Student Chapter during the past school year. In addition, there were 13 meetings, with a total attendance of 445. These sessions were addressed by students and outside speakers. Among the latter were Joseph Jacobs, consulting engineer of Seattle, Wash.; Ivan C. Crawford, Director of the Society and state (Idaho) engineer for the Public Works Administration; and R. M. Murray, resident engineer of the Washington State Department of Highways.

ITEMS OF INTEREST

Engineering Events in Brief

Civil Engineering for January

A LARGE PART of the January issue will be devoted to articles on various phases of the Muskingum flood control project abstracted from papers presented before the Zanesville (Ohio) Regional Meeting, on October 4, 1935. This $34,500,000 project involves the construction of 14 dams and relocation of various railroads, highways, and utilities, under a cooperative arrangement between the federal government and the Muskingum Conservancy District. Among the subjects of the addresses are history of the project, general project design, and description of project works; design of dams, hydraulic model studies, railroad relocations, highway relocations, public utility relocations, control of embankment construction, and soil-mechanics application and laboratory practice. If space permits, a few general articles will also be included.

The Early Days of Materials Testing

IT WAS ALMOST 150 years ago that Jean Rondelet built, in France, the first "modern" testing machine—the first apparatus to embody the principles of screw-power, a lever and poise mechanism, and frictionless (knife-edge) supports. Its capacity was 35,000 lb.

The accompanying illustration, reproduced from an engraving in Rondelet's "Traité de l'Art de Bâtir" (6th ed., 1830) shows a small compression test specimen in position between the vertical supports at the right end of the horizontal arm. In beginning a test, this arm was temporarily supported in a horizontal position while cast-iron blocks were placed above and below the specimen to fill the vertical slot. A heavy square-threaded screw, whose upper end is attached to the metal arc marked "f," was then tightened until the long arm would remain horizontal without support.

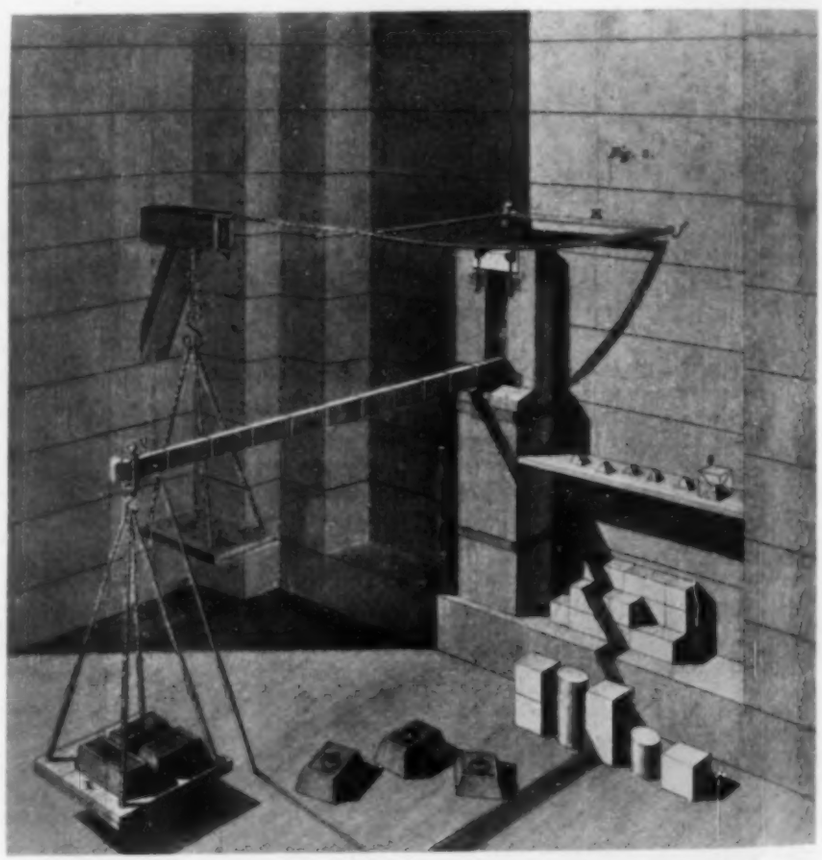
Load was increased gradually by adding weights to the balance pan in the foreground. As the arm lowered it could be brought back to horizontal by adding weights to the other pan, whose supporting rope was attached to the metal arc controlling the screw.

Rondelet recognized the importance of the time factor in materials testing and specifically warned that load must be applied gradually, taking care to permit sufficient time to elapse for the full effect of each incremental load to develop. He also took into account the unbalanced weight of the lever in computing the load on his specimens.

The art of testing materials is itself about twice as old as the machine just described. In 1638, Galileo made tension tests on copper, probably using dead weights to load the specimen. He did not express the ultimate strength directly in terms of unit stress, but determined the maximum length of wire which could support its own weight. About 40 years after his experiments, the law of proportionality of stress to strain was formulated by Hooke—whom someone has described as "an Englishman of great genius but unpleasant temperament" (see Unwin's lecture in *Proceedings*, Institution of Mechanical Engineers, October 1918, p. 407).

Materials testing was now on a sound basis. Oddly enough, it was not until 1807 that Young defined the modulus of elasticity. But after Hooke's principle was established, there was a rapid growth of the study of strength of materials. Muschenbroeck was probably the first to build an actual testing machine with levers, and many other experimenters contributed to the development of this science. But even the contemporaries of Rondelet—Gauthey and Soufflot—produced in 1775 a testing machine which was still little more than a heavy lever. It was pin-connected, and Rondelet says the friction on this bearing was so great that when the balance plate carried more than 200 lb it was impossible to obtain good results. Moreover, there was no compensation for the lever motion, and as the specimen was compressed the arm sagged farther and farther from the horizontal. It was the defects of this machine that gave Rondelet the inspiration for the improvements incorporated in his equipment 12 years later.

A recent book by Chester H. Gibbons entitled *Materials Testing Machines* is largely devoted to a historical account of the development of testing machines. No small part of the value of this book is in the comprehensive bibliography on the subject which it contains. These references are conveniently arranged in footnote form. The information in the present article has been got mainly from the previously mentioned treatise by Rondelet and lecture by Unwin.



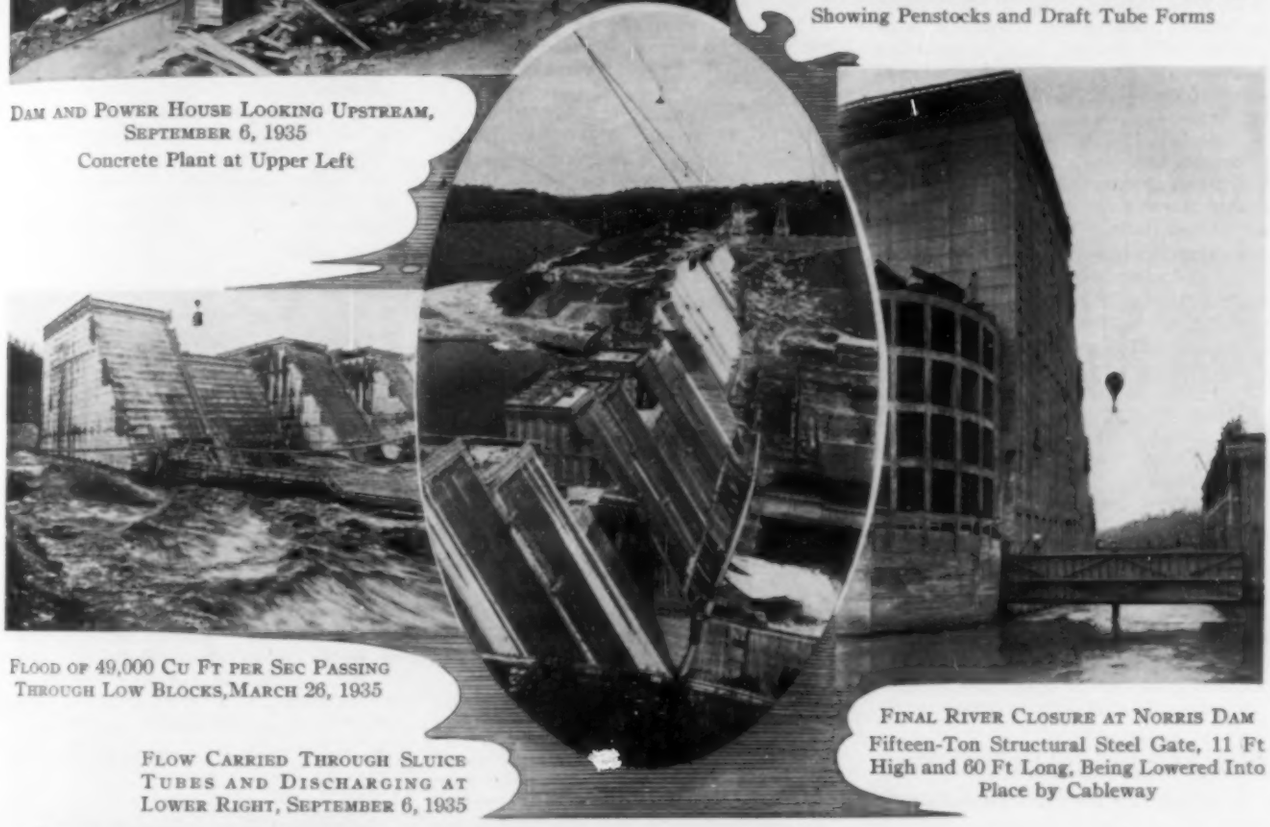
A FAMOUS 18TH CENTURY TESTING MACHINE
Knife-Edge Supports and Screw-Power Were Features of This Apparatus, Built by Rondelet in 1787

Norris Dam Assumes Final Form

Some Unusual Views from TVA Files Show Variety of Early and Recent Activities

Dam and Power House Looking Upstream, September 6, 1935
Concrete Plant at Upper Left

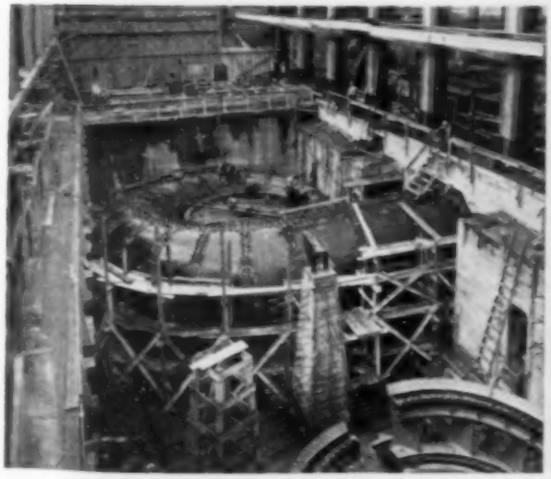
View Looking Into Power House Substructure
Showing Penstocks and Draft Tube Forms



Flood of 49,000 Cu Ft per Sec Passing Through Low Blocks, March 26, 1935

Flow Carried Through Sluice Tubes and Discharging at Lower Right, September 6, 1935

Final River Closure at Norris Dam
Fifteen-Ton Structural Steel Gate, 11 Ft High and 60 Ft Long, Being Lowered Into Place by Cableway



Power House Construction on October 21, 1935

Heavy-Duty Concrete Road Between Coal Creek and Norris Dam

A Windowless Office Building

AT HERSHEY, Pa., 15 miles from Harrisburg, M. S. Hershey is erecting a large 3-story office building without windows as an addition to the plant of the Hershey Chocolate Corporation. The building is scheduled for occupancy about January 1, 1936. This is one more item in the one-man construction program begun by Mr. Hershey 32 years ago, when he started building homes for the workers. Most of his structures have been designed directly for community use. To this group belong a large modern open-air swimming pool; a public park; a well-equipped zoological garden; an imposing library; a recreation center (occupying a full city block) complete with theater, hospital, dormitory, gymnasium, and game rooms; a large modern hotel located in a commanding position; and an academic and vocational school where Mr. Hershey is now educating 800 boys.

The office building (architect's sketch shown on this page) is 151 ft wide and 308 ft long, having a basement and three stories above ground. The walls are of native limestone. The roof is level and will carry 2½ in. of water at all times to act as insulation. Over each of the entrances on the west elevation there will be luminous panels 36 ft high, as well as on the side facing the avenue. The following is quoted from a recent news release:

"Six reasons will be given why the windowless building is considered an improvement over existing structures. In the first place, there will be better illumination. Secondly, there will be better air conditioning in both summer and winter. In the third place, distracting noises from the exterior of the building will be eliminated. It will be economical in that it will require less refrigeration and less heat. There will be less wasted floor space and also an easier arrangement of equipment and fixtures for office use, printing plant, and locker room.

"Since there will be no windows, the matter of acoustics is more important than ever. We intend to treat enough of the room surfaces with sound-absorbing materials so that ordinary echoes will be kept to a minimum. The ceilings will be treated with cork, properly compressed for the absorption of sound and with a decorative surface.

"It is an established fact that the combination of daylight and artificial light with its varying qualities causes eye strain. By having conditions as we have arranged them in the office building, excluding natural light, a constant intensity of proper quality of light can be had.

"We decided to have the finest kind of lighting known, namely, mercury vapor modified by mazda lamps. The resultant mixture gives a light which very closely approaches that of true sunlight. The fixtures being used will throw approximately 95 per cent of the light against the ceilings and side walls with only a small amount, about 5 per cent, coming through the fixture itself.

"The air-conditioning system will include, in addition to refrigeration, two separate air-washing systems which will maintain interior conditions of maximum comfort both in summer and winter. Conditions to be maintained are 80 F dry-bulb temperature with 65 F wet-bulb in the summer, and 75 F dry-bulb temperature with a 48 per cent relative humidity in the winter. A complete system of fans, with air ducts, grilles, and accessory equipment will insure circulation of conditioned air at the rate of 90,000 cu ft per min, with a constant supply of outside air introduced at all times to keep the air fresh.

ARCHITECT'S SKETCH OF WINDOWLESS OFFICE BUILDING AT HERSHEY, PA.
What Appear to Be Windows Are in Reality Luminous Panels Which Will Throw an Amber Glow Over the Building

New Manuscript on Soil-Mass Dynamics Filed in Library

A PAPER entitled "Principles of Soil-Mass Dynamics," by Prof. N. M. Gersevanov, of the Scientific Foundation Research Institute, Moscow, Russia, has recently been placed on file in the Engineering Societies Library, where it is available for study by anyone interested. It is written in English.

This manuscript of perhaps 40,000 words commences with an outline of the basic principles of soil mechanics. Volume of voids, permeability, and capillarity are discussed at length. A brief description of the tests proposed by Charles Terzaghi, M. Am. Soc. C.E., is presented. The author then discusses the question of hydrostatic uplift through soils and reaches the conclusion that full uplift must always exist under static conditions; smaller or greater values of uplift may be shown by tests to be due to dynamic effects. Negative hydrostatic pressure due to capillarity is explained. Shrinking and swelling phenomena are then discussed.

The last half of the manuscript is devoted to the development of equations dealing with the settlement of foundations. The general approach to this problem is similar to that used by Dr. Terzaghi in his *Erdbaumechanik*. Professor Gersevanov, however, includes in his solution of this problem the effect of the movement of the soil skeleton as well as that of the soil water as consolidation takes place. Dr. Terzaghi assumed the soil skeleton to be immobile, neglecting any effect due to this movement, which Professor Gersevanov finds to be of considerable importance. The development of the differential equations necessary for the solution is carried out in detail for a general case with the necessary boundary conditions satisfied. The resulting formula is then simplified to a form recommended for use in practice, as indicated by an example.

A discussion of Darcy's law and the filtration theory, together with descriptions of various tests for the coefficient of permeability, concludes the manuscript.

CIVIL ENGINEERING is indebted to Fred L. Plummer, Assoc. M. Am. Soc. C.E., for this abstract of Prof. Gersevanov's paper. A shorter paper by the same author, also abstracted by Professor Plummer, was published in the October issue under the title, "Models Illustrate Work of Soil-Mass in Foundations."

EIGHTY-THIRD ANNUAL MEETING, January 15–18, 1936, in New York, N.Y., at Society Headquarters

Sidewalks Along State Highways Being Built in Massachusetts with WPA Funds

NEW ENGLAND, appalled at the number of pedestrians killed on highways, is the first region to adopt safety facilities on a large scale for pedestrians on state roads. An $8,000,000 federal-state project to construct nearly a thousand miles of asphalt sidewalks along state highways in Massachusetts has been approved. The plan is for the WPA to grade the sidewalks and provide the gravel, while the state will construct the curbstones and surfacing. The state's share of the money will come from a bond issue voted by the recent legislature.

No other state has built highway sidewalks on a scale comparable with that planned by Massachusetts; in fact there have been no state highway sidewalks to speak of, beyond some isolated miles in a few states. Capital reports indicate, however, that many other states, spurred by figures showing that 15,950 pedestrians throughout the country were killed by automobiles last year, 2,690 of them on rural highways, are planning WPA projects similar to that of Massachusetts.

From time immemorial the pedestrian has had the same legal rights on the highway as vehicular traffic—whether horse drawn, pedal driven, or motor driven. That rule and law go back to the English "common law," which is the basis of all economic law in English-speaking countries and has been reenacted by legislatures and recognized by the courts during all the intervening years.

The *Cyclopedia of Automobile Law*, by DeWitt C. Blashfield, 1932, quoting from Alpert V. Ellis, 128, N.Y. 684, states:

"A motorist who, in the night time, overtakes and runs down a pedestrian traveling, so far as the evidence shows, in the regular course on the right side of the road, without veering to the one side or the other, may be found to be negligent."

This ruling, of course, has been superseded in New York by a state law providing for pedestrians to walk on the left—although this often only means that the pedestrian is hit a little harder than he would be if he were walking with the traffic.

Again, in the *Law of Automobiles*, by C. P. Berry, 1927, it is stated:

"Where there is no sidewalk, pedestrians' rights upon the paved roadway are equal to those of vehicles. King V. Brillhart, 271 Pa. St. 301."

Attempts of pedestrians to assert these equal rights with safety have not been eminently successful, in the past few years at least, and it has been suggested that, regardless of state laws, political bodies having jurisdiction over highways under the common law are derelict of duty and liable for damages in cases of accidents to pedestrians where no adequately safe provisions have been made for walkways.

The State of New Jersey became the first to provide reform legislation when in 1930 its legislature enacted the following:

"In addition to the powers conferred upon the State Highway Commission it shall be lawful, and the commission is hereby authorized and empowered, to construct paths or sidewalks and curbing along state highways, and other roads and highways, subject to the jurisdiction of the commission."

Subsequently several states enacted similar laws and others have them under consideration. The Massachusetts law (1931) reads:

"The division shall from time to time construct sidewalks along such parts of the state highways as it determines public necessity and convenience require."

New York now has a law permitting a town to petition a county for the construction of sidewalks along a state highway. If the county consents, it must pay 65 per cent of the cost and the town 35 per cent. The only way the state comes into the picture is that it must approve the plans for the sidewalk—the object being to see that the sidewalk is so located that pedestrians will not be endangered and that the sidewalks will not be destroyed through future development of the road.

NEWS OF ENGINEERS

From Correspondence and Society Files

JOHN F. STEVENS, Past-President and Honorary Member of the Society, is to be honored by having his photograph appear on a 5-cent stamp soon to be issued. Mr. Stevens was chief engineer of the Panama Canal from 1905 to 1907, and for part of the latter year was chairman of the Isthmian Canal Commission. During the World War he served the government as chairman of the Commission of Railway Experts to Russia, and from 1919 to 1923 was president of the Inter-Allied Technical Board charged with the administration and operation of all Russian railroads occupied by foreign troops.

JOHN F. STEVENS

WINTERS HAYDOCK, formerly directing engineer for the Pittsburgh (Pa.) Department of City Transit, has established a consulting engineering practice at 430 Olympia Road, Pittsburgh.

CHARLES SEGER, formerly resident engineer for the Middle Rio Grande Conservancy District, has accepted a position in a similar capacity on the construction of Buchanan Dam on the Colorado River in Texas.

CHITTY HO has joined the staff of Pei-Yang University in Tientsin, China, in the capacity of professor of hydraulic engineering and experimental hydraulics. He was previously in the Bureau of Hydraulic Engineering of the National Economic Council at Nanking.

PAUL W. THOMPSON, recently appointed Freeman traveling scholar by the Society, has left the U. S. Engineer Office in Omaha, Nebr., and sailed for Europe. His present address is in care of the Military Attaché, American Embassy, 30 Tiergartenstrasse, Berlin, Germany.

M. S. BITNER, who recently completed his work for the Bloomington and Normal Sanitary District of Bloomington, Ill., is now project engineer in the office of the Moffat water tunnel project in Denver, Colo.

W. A. HITCHCOCK is at present connected with the Resettlement Administration as assistant chief of section, engineering, and construction, in the Suburban Resettlement Division, with headquarters in Washington, D.C.

ALFRED M. WYMAN is now supervisor of projects and planning for the Works Progress Administration, 3d New York district, with headquarters in White Plains, N.Y.

WILLIAM H. BARTON, JR., recently resigned as professor of civil engineering at Pennsylvania Military College to join the scientific staff of the American Museum of Natural History in New York, N.Y., in the capacity of associate curator. Mr. Barton will assist in the mangement of the newly opened Hayden Planetarium.

E. K. DEWEY has been made general superintendent of the Max B. Miller Company, Inc., of Ponca City, Okla.

HAROLD N. DAVIDSON has taken a position in the Bridge Department of the Arkansas Highway Department at Little Rock, Ark., in the capacity of draftsman and designer. Previously he was with the G. H. Hammond Company, of Chicago, Ill.

RUSSELL C. BRINKER, for the past five years an instructor in civil engineering at the University of Minnesota, has now accepted a position as instructor in civil engineering at the University of Hawaii in Honolulu.

RUSKIN T. GARDNER has accepted an engineering position with the Wallace and Tiernan Company, for which he will travel over seven Pacific Coast States. His headquarters are in Salt Lake City, Utah. He was previously assistant superintendent of the Phoenix (Ariz.) water department.

CLARENCE MCDONOUGH recently resigned as director of engineering for the Public Works Administration in Washington, D.C., to become general manager of the Lower Colorado River Authority, with headquarters in Austin, Tex.

F. W. DANIELS, of Charleston, W.Va., has taken an engineering position with the H. K. Ferguson Company, of Cleveland, Ohio.

ALFRED R. GOLZÉ, formerly an assistant engineer in the Denver office of the U. S. Bureau of Reclamation, has been transferred to the Washington, D.C., office of the same organization where he will be an assistant to D. S. Stuver, supervising engineer.

R. M. WYNNE-EDWARDS has joined the staff of John Mowlem and Company, Ltd., on the construction of the new Chingford reservoir at Chingford, England.

JOHN E. HOWE is temporarily employed by the Tennessee Eastman Corporation of Kingsport, Tenn., in the capacity of structural designer. He was previously chief of party for the Rural Electrification Survey, with headquarters in Worcester, Mass.

FRANKLIN F. SNYDER, formerly a junior engineer in the U. S. Geological Survey, is now in the General Engineering Division of the Tennessee Valley Authority. His headquarters are in Knoxville, Tenn.

P. O. ROBERTS has been transferred from the Inspection Division of the Public Works Administration to the Division of Investigations of the same organization in the capacity of engineer investigator. His office is in Kansas City, Mo.

LOWELL O. STEWART was recently appointed personnel officer for the Division of Engineering of Iowa State College at Ames, Iowa, where he will supervise all personnel work in the division. He was previously associate professor of civil engineering in the same institution.

ORDISS FORBESS, formerly assistant office engineer in the Texas State Highway Department, is now employed as county engineer, with headquarters at Levelland, Tex.

JOSEPH J. RIMSAY has resigned as instrumentman with the North Dakota State Highway Department to accept an appointment as junior highway engineer with the state of Illinois Division of Highways, with offices in Carbondale, Ill.

HARRY N. PHARR recently resigned as chief engineer of the St. Francis Levee Board to become a member of the Mississippi River Commission, with offices in Memphis, Tenn.

ELLSWORTH S. WEED, formerly an assistant engineer on the Water and Power Resources Board of Harrisburg, Pa., has taken a position in a similar capacity on the Quoddy Power Project at Eastport, Me.

GEORGE P. STOWITTS has been made chief engineer of the Inspection Division of the Public Works Administration, with headquarters in Washington, D.C.

IRVING E. MATTHEWS has resigned as city engineer of Rochester, N.Y., to establish a consulting engineering practice at 65 Broad Street, Rochester.

CLARENCE D. HOWE, consulting engineer of Port Arthur, Ontario, was recently appointed a member of Premier King's cabinet, in Ottawa, Canada, as Minister of Railways and Canals and Minister of Marine. It is the intention to combine

CLARENCE D. HOWE

these two portfolios into the Ministry of Transport and Communications. Included in the two departments is administration of canals, railways, harbors, the radio commission, lighthouses, and marine services. Mr. Howe is the first professional engineer to be charged with the administration of an engineering portfolio.

OLIVIER O. LEFEBVRE, chief engineer of the Quebec Streams Commission, of Montreal, Canada, is one of three engineers appointed by the provincial government of Quebec to make up the recently authorized Quebec Electricity Commission.

RALPH R. BENEDICT, formerly engineering secretary in the Illinois State Department of Public Works, Division of Highways, is now an associate highway engineer in the Division of Design, U. S. Bureau of Public Roads, with headquarters in Washington, D.C.

CHARLES W. OKEY recently joined the engineering staff of the Tennessee Valley Authority as principal engineer in the General Engineering Division. His headquarters are in Knoxville, Tenn. He was previously an engineer for the Lesser-Goldman Cotton Company of Walnut Ridge, Ark.

GERALD MARCY KEITH is now engineer and treasurer for the Shore-line Builders, Inc., of Jacksonville, Fla.

NATHAN B. JACOBS has been promoted from the position of vice-president of Morris Knowles, Inc., of Pittsburgh, Pa., to that of president.

WILLIAM C. REEDER, surveyor and regulator of the 2d Philadelphia district, was recently awarded a medal by the American Society of Municipal Engineers. This medal, which was presented at the Public Works Congress held in Cincinnati on October 15, was given in recognition of Mr. Reeder's 43 years of service in a single community.

RICHARD D. FIELD, formerly a bridge designer in the New Hampshire State Highway Department, is now an engineer examiner for the National Power Policy Committee on the Passamaquoddy tidal project. His headquarters are in Eastport, Me.

DECEASED

AUGUST JOHN BARITELL (Assoc. M. '20) of Los Angeles, Calif., died on July 23, 1935, at the age of 52. He was born in Villar, Italy, and began his engineering career in this country in 1904. Prior to 1920, he was employed as a draftsman, transitman, chief of party, and locating engineer on railway surveys in the South and Far West.

WILLIAM STODDERT CARUTHERS (M. '13) died in Berkeley, Calif., on November 1, 1935, at the age of 72. He was born in Jackson, Tenn., and attended the University of Missouri. His engineering career, previous to 1912, was devoted particularly to railroad construction and line revision work in the West. Among the many railroads by which he was employed were the Chicago, Rock Island and Pacific Railway, the Northern Pacific, the Western Pacific, and the Union Pacific. In recent years he has made his home in California.

LEVI OSCAR COLEMAN (Assoc. M. '23) died at Beaver Dam, Ky., on July 9, 1935, at the age of 48. He was born in Paradise, Ky., and graduated from the College of Engineering of the University of Kentucky in 1914. His early experience was with the Delaware, Lackawanna and Western Railway and the Interstate Commerce Commission. From 1917 to 1919 he was in the U. S. Army, engaged in training troops in this country and in supervising the construction of roads in France. After the war he became associated with the Illinois Division of Highways.

JOHN FRANCIS CUSHING (M. '27) president of the Great Lakes Dredge and Dock Company of Chicago, Ill., was killed in an airplane accident on October 7, 1935. He was born at Arapahoe, Nebr., on May 21, 1882, and graduated from the University of Notre Dame in 1906, with the degree of C.E. A specialist in the construction of marine, river, and harbor improvements, Mr. Cushing was responsible for the construction of various engineering works in Chicago. In 1910 he joined the staff of the Great Lakes Dredge and Dock Company, serving in various

capacities until 1928 when he was made president.

JAMES BLAINE FORD (Assoc. M. '24) died on September 25, 1935. He was born February 14, 1885, at Geneva, Ill. His engineering career began in 1905 when he engaged in various railroad, topographic, and land surveys in the Northwest. He was employed in this type of work in various parts of the country until 1918 when he became affiliated with the Roane Iron Company, of Rockwood, Tenn., in the capacity of assistant chief engineer. From 1923 until the time of his death he was chief engineer in charge of all civil, mechanical, mining, and electrical work.

WILLIAM BECK GODDARD, JR. (M. '12) of San Antonio, Tex., died in February 1935, at the age of 65. He was born in Austin, Tex., and began his engineering career in 1890. Mr. Goddard served as chief engineer and general manager of several construction and consulting engineering firms, previous to 1920. In this capacity he was responsible for the design and construction of numerous structures in New York City, of the Detroit (Mich.) terminal for the Michigan Central Railroad, and of a large steel hotel building in Buenos Aires.

CASPAR WISTAR HAINES (M. '91) retired civil engineer, who built railroads in Mexico and Guatemala, as well as in this country, died in Germantown, Philadelphia, Pa., on October 12, 1935. A member of an old Philadelphia family, he was born in Cheltenham, Pa., 82 years ago. Mr. Haines attended West Town Friends School, Haverford College, and Lehigh University from which was he graduated in 1874. His engineering career included construction of the Mexican National Railroad and the Inter-Continental Railroad of Guatemala. He made astronomical observations in Buenos Aires for the U. S. government, and in this country was associated with the Richmond, Fredericksburg and Potomac Railroad and with the Pennsylvania Railroad.

JOHN FRANCIS LE BARON (M. '82) who died on October 1, 1935, had more than sixty years of engineering experience in the United States, Canada, Mexico, and Central America in all types of public works and surveys. He served in an engineering or superintending capacity on the construction of many important projects, including the Nicaragua ship canal, the Hoosac tunnel route of the Fitchburg Railroad, the Nicaragua Canal Railroad, and the St. John's and Indian River Railroad.

ROBERT WHITMAN LESLEY (Aff. '93) director of the Giant Portland Cement Company of Philadelphia, Pa., died at Bryn Mawr on November 9, 1935, in his 83d year. He was born in Philadelphia, attended the University of Pennsylvania, and in 1879 was admitted to the bar. He took out many patents in connection with the manufacture of portland cement and became the first president of the Portland Cement Association. Mr. Lesley was donor of a cement laboratory to the University of Pennsylvania. He was associated with the development of inventions in the field of aviation, and with regional planning and welfare and civic activities. He contributed largely to the pleasures incident to the visit of the Society for its meeting in October 1926 at the time of the Sesquicentennial Celebration.

HARRY CLIFFORD MC CLURE (Assoc. M. '13) associated with the Michigan Public Utilities Commission, died in Lansing, Mich., on November 9, 1935. He was born in Mansfield, Ohio, on August 15, 1884, and graduated from the University of Kansas in 1909, with the degree of B.S. in C.E. In 1914 he received the degree of C.E. from the University of Kansas, and in 1915 a similar degree from the University of Michigan. He has been prominent in the engineering development of Toledo, Ohio, having been an engineer for the Board of Education of that city from 1909 to 1916, and city engineer from 1916 to 1920. During the War he was a captain in the Ordnance Department of the U. S. Army, in charge of roads, sewers, and trucks at the government nitrate plant at Ancor, Ohio.

The Society welcomes additional biographical material to supplement these brief notes and to be available for use in the official memoirs for "Transactions."

IRWIN SELDEN OSBORN (M. '16) vice-president of the C. O. Bartlett and Snow Company, of Cleveland, died in that city on November 2, 1935, at the age of 56. A graduate of both Oberlin College and Purdue University, Mr. Osborn for 20 years acted as consulting engineer for a number of cities in both the United States and Canada. At the time of his death he was known as an authority on the disposal of municipal waste and had recently completed the design and construction of a garbage disposal plant for the city of Cleveland.

CHARLES SCHULTZE SAMPLE (M. '30) principal assistant engineer on the Missouri Pacific Railroad, died on September 25, 1935. He was born at Philo, Ill., on June 1, 1873, and graduated from Purdue University in 1899, with the degree of B.S. in C.E. He has done important work on the revision of railway grades and lines in Missouri, Kansas, and Arkansas. In 1909 he became associated with the Missouri Pacific Railroad, where he held various titles, rising to the position of principal assistant engineer.

THOMAS SHACKELFORD SHEPPERD (M. '17) former president of Ulen and Company, died at Lebanon, Ind., on November 8, 1935, at the age of 54. His engineering career, which began in 1900, took him to Alaska, Mexico, Poland, and Greece. His work abroad included supervision of the construction of sewerage and water works systems for four towns in Poland, and of a new water system for Athens, Greece. Among his important achievements in this country was his work as engineer in charge of construction of the Shandaken tunnel, which carries water for the city of New York through the Catskill Mountains.

WILLIAM LUTHER SIBERT (M. '97) Major General, U. S. Army, retired, and chief engineer of the Alabama State Docks Commission, died at Bowling Green, Ky., on October 16, 1935, at the age of 75. He was born at Gadsden, Ala. After attending the University of Alabama from 1878 to 1880, he was appointed to the U. S. Military Academy at West Point, from which he graduated in 1884. General Sibert was well known on account of his work in connection with the building of the Gatun locks and dams and other important phases of the construction of the Panama Canal. In recognition of his services he was raised to the rank of brigadier general. He was the last surviving member of the Isthmian Canal Commission. Besides constructing numerous river and harbor improvements in this country, General Sibert went to China as chairman of the board of engineers on the prevention of floods in the Huai River valley. At the outbreak of the World War he was made a major general and placed in command of the First Division, A.E.F. General Sibert was known for his services as chairman of the Colorado River Board appointed in 1928 by authority of Congress to report on the salient features of the Boulder Canyon project.

EUGENE ADALBERT SILAGI (M. '17) sales manager for the China United Engineering Corporation, in Shanghai, China, died on April 5, 1935, at the age of 58. He was born in Rozsnyo, Hungary, and received a civil engineering degree from the Joseph Royal Technical University in Budapest in 1898. After four years in the Hungarian army he was employed in an engineering capacity in Tomsk, Siberia, and in Algeria, North Africa. From 1907 to 1913 he was employed on the design of concrete structures in Detroit, Mich. After that his engineering work took him to several American and foreign cities, the latter including Singapore, Manila, and Honolulu.

CARL STOPP (Jun. '30) chief assistant to the resident engineer on the construction of Alton Dam on the Mississippi, died at Alton, Ill., on November 8, 1935, as the result of injuries received in a fall from a concrete pier. He was born in St. Louis, Mo., on November 5, 1907, and graduated from Washington University in 1930, with the degree of B.S. in civil engineering. After his graduation he joined the staff of the U. S. Engineer Department, St. Louis District, serving in varying capacities on hydrographic surveys, the design and construction of river structures, and pump, engine, and boiler testing.

JAMES WINGATE ROLLINS, JR. (M. '00) civil engineer and vice-president and treasurer of the Blakeslee Rollins Corporation since 1924, died in Milton, Mass., on November 19, 1935, at the age of 77. He was born in Boston, Mass., and graduated from Massachusetts Institute of Technol-

ogy in 1878. He was formerly a member of Holbrook, Cabot, and Daly, general contractors, and was president of the Holbrook, Cabot, and Rollins Corporation from 1906 until its dissolution several years ago.

DANIEL ULRICH (Assoc. M. '97) assistant district engineer for the North Carolina State Highway Commission, 3d district, died on November 7, 1935. He was born in 1860 and graduated from Pennsylvania State College in 1890, with the degree of C.E. Prior to 1897, Mr. Ulrich was employed in several engineering capacities on the construction of railroads, docks, warehouses, power houses, dams, and weirs, in this country and in Cuba.

STANDISH WESTON (Jun. '31) of the Department of Civil and Military Engineering at the U. S. Military Academy at West Point, died in Washington, D.C., on October 29, 1935, at the age of 33. Captain Weston, Corps of Engineers, U. S. Army, was born in Washington, D.C., and graduated from the U. S. Military Academy in 1925. He also received the degrees of A.B. in 1928 and A.M. in 1934 from Oxford University, England, being the first graduate of the U. S. Military Academy to go to Oxford University as a Rhodes scholar. In 1931 he received the B.S. degree from Massachusetts Institute of Technology, and in 1932 was graduated from the company officers' course.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From October 10 to November 9, 1935, Inclusive

ADDITIONS TO MEMBERSHIP

ALEXANDER ANDREW (Jun. '35), 69 Elizabeth Ave., Arlington, N.J.

BARNES, WILLIAM FRANCIS, JR. (Jun. '35), 24 South Central Ave., Chicago, Ill.

BEIER, HERBERT DONALD (Jun. '35), 2690 Morris Ave., New York, N.Y.

BELL, HAROLD BRADFORD (Jun. '35), 47 Hale St., Leominster, Mass.

BERKEY, ESTO RAY (Jun. '35), 1020 Bluemont Ave., Manhattan, Kans.

BLISS, HAROLD PAUL (M. '35), Asst. Civ. Engr., Dept. of Water and Power, City of Los Angeles (Res., 350 Dalkeith Ave.), Los Angeles, Calif.

BOHL, LEIGHTON THETERICK (M. '35), Prof. Civ. Eng., Brown Univ., Providence (Res., 32 Henry St., Edgewood), R.I.

BRAUN, HENRY (Jun. '35), Engr., Joseph Meltzer, Inc. (Res., 463 West 47th St.), New York, N.Y.

BRAUN, HOWARD CLYDE, JR. (Jun. '35), 51 Colorado Ave., Dayton, Ohio.

BROYLES, HARMON CLETUS (Jun. '35), Box 503, Blacksburg, Va.

BRUMMETT, R. C. (Jun. '35), Instrumentman, U. S. Reclamation Service, ECW, 100 S. Ash St., Carlsbad, N.Mex.

BURKY, JOHN DRUMMOND (Jun. '35), 4050 East 17th Ave., Denver, Colo.

CAIN, VERNON Y. (Jun. '35), 711 South 1st St., Lufkin, Tex.

CAPP, MARTIN PHILIP (Jun. '35), 568 Lafayette St., Denver, Colo.

CARTER, WILLIAM RICHARD (Jun. 35), 3046 Martin Ave., Omaha, Nebr.

CLEMENT, BLANTON (Assoc. M. '35), Junior Project Mgr., National Park Service, Land Program Div., Box 112, Madison, Ga.

CONLEY, FRANCIS HARRY (Assoc. M. '35), Prin. Eng. Aide, TVA, Eng. Service Div.; 472 North Court St., Florence, Ala.

DAVIDSON, SAM NORRIS (Jun. '35), Box 372, Longview, Tex.

DE GENNARO, PETER FRANK (Jun. '35), 34 Howell Pl., Arlington, N.J.

DELAPP, WARREN WILLIAM (Jun. '35), 1110 Polk, Topeka, Kans.

DEL FAVERO, LOUIS VINCENT (Jun. '35), R. D. 1, Route 1, Columbia, N.J.

DOAK, JOHN (Assoc. M. '35), Asst. Supt. of Buildings, Univ. of Illinois, 110 Power Plant, Urbana, Ill.

EAST, HUDSON CLAIBORNE (Jun. '35), Care, Knapp & East, Box 537, Lake Charles, La.

EDMONDS, DONALD JOHN (Jun. '35), 873 East 9th St., Brooklyn, N.Y.

FADUM, EIGIL RALPH (Jun. '35), E-33 Morris Hall, Soldiers Field, Boston, Mass.

FITZGERALD, JAMES AUGUSTINE (Jun. '35), 234 Highland Ave., Ravenna, Ohio.

FRICKER, FRANK FRED (Jun. '35), 869 Winton Ave., Akron, Ohio.

GOODHART, MORRIS (Jun. '35), Overbrook Rd., Pikesville, Md.

GRADY, HAMILTON GAMBLE (Assoc. M. '35), Design Engr., Consolidated Steel Corporation, Ltd. (Res., 1572 Oak Grove Drive), Los Angeles, Calif.

GRANBERG, ROBERT JAMES (Jun. '35), Care, Prof. Walter C. Voss, 9 Old Town Rd., Wellesley Farms, Mass.

GROSS, CHARLES EDWARD (Jun. '35), Carlisle, Ohio.

HABIG, WILLIAM ALBERT (Jun. '35), 770 South 12th St., Newark, N.J.

HADLEY, WILLIAM ALONZO (Assoc. M. '35), Asst. Div. Engr., State Road Dept. (Res., 4 Lake Hollingsworth Drive), Lakeland, Fla.

HAMILTON, WALLIS SYLVESTER (Jun. '35), With Gen. Eng. Div., TVA (Res., 1305 West Clinch Ave.), Knoxville, Tenn.

HARPER, DONALD ARTHUR (Jun. '35), 345 Sylvia St., West Lafayette, Ind.

HARVEY, KENNETH HOWARD (Jun. '35), Eng. Asst., Finch, Pruyn & Co. (Res., 16 Gage Ave.), Glens Falls, N.Y.

HAUER, GERALD ELTON (Jun. '35), 43 Dickinson St., S.W., Grand Rapids, Mich.

HEOY, WILLIAM ZOLTON (Jun. '35), 67 South 5th St., San José, Calif.

HENDERSON, HAROLD RAINS (Jun. '35), County Engr., Harrison County, Box 86, Marshall, Tex.

HENDRICK, JASPER REGINALD (Jun. '35), 1605 Fifth Ave., Fort Worth, Tex.

HILL, RANDOLPH WILLIAM (Jun. '35), 834 Longwood Ave., Los Angeles, Calif.

HITTER, AARON (Jun. '35), 2350 Davidson Ave., New York, N.Y.

HOLLEY, ROBERT PAUL (Assoc. M. '35), Asst. Highway Engr., TVA, La Follette, Tenn.

HOLOBER, DAVID GEORGE (Jun. '35), 1443 Thirty-Eighth St., Brooklyn, N.Y.

HOUSE, HARRY M. (Assoc. M. '35), Asst. State Engr., FERA in Oklahoma (Res., 1025 North East 11th St.), Oklahoma City, Okla.

JACOBSON, HAROLD (Jun. '35), 1507 Morris Ave., New York, N.Y.

JAMES, RUSSELL WALKER (Assoc. M. '35), Associate Highway Bridge Engr., Bureau of Public Roads, U. S. Dept. of Agriculture (Res., 376 Clermont St.), Denver, Colo.

JANVIER, GEORGE, JR. (Jun. '35), 1521 Seventh St., New Orleans, La.

JEWELL, WENDELL DENNING (Jun. '35), With Thomas B. Card, 840 Hospital Trust Bldg. (Res., 5 Sampson Ave.), Providence, R.I.

JONES, JO BUCK (Assoc. M. '35), State Engr., Transient Div., Texas Relief Comm., 931 North Queen St., Palestine, Tex.

JUNO, EUGENE EDWARD (Jun. '35), 91 Ayer Ave., San José, Calif.

KLAHN, SIDNEY WILLIAM (Assoc. M. '35), Field

TOTAL MEMBERSHIP AS OF NOVEMBER 9, 1935

Members	5,726
Associate Members	6,087
Corporate Members	11,813
Honorary Members	21
Juniors	3,017
Affiliates	96
Fellows	2
Total	14,949

ENGR., Pure Iron Culvert & Mfg. Co., Portland (Res., 1980 South Church St., Salem), Ore.

LADUE, WILLIAM EDWARD (Jun. '35), 2319 O St., Sacramento, Calif.

LANE, PAUL VAUX (Assoc. M. '35), 4911 San Rafael Ave., Los Angeles, Calif.

LEBA, THEODORE, JR. (Jun. '35), 171 Van Buren St., Newark, N.J.

LIEBROR, RINARD THEODORE, JR. (Jun. '35), Dist. Engr., U. S. Govt., Works Div., FERA, Box 624, Devils Lake, N.Dak.

LINDL, GORDON JOSEPH (Jun. '35), 830 Sixty-Fourth St., Kenosha, Wis.

LIU, TE-YUN (Jun. '35), 323 South Capital St., Iowa City, Iowa.

LOVELESS, COMPERE (Jun. '35), 608 Waldron St., West Lafayette, Ind.

MACGREGOR, ARTHUR SIDNEY (M. '35), Engr. of Building Constr., State Dept. of Public Works, 29 West Bank St., Albion, N.Y.

MCARTHUR, THOMAS JOSEPH (Jun. '35), 32–53 Forty-Third St., Long Island City, N.Y.

MCCARTHY, GERALD TIMOTHY (Jun. '35), U. S. Engr. Office, Eastport, Me.

MCCLARRAN, WILLIAM HARRY (Jun. '35), 246 North Broadway, New Philadelphia, Ohio.

MCEOWEN, ALBERT VINCENT (Jun. '35), 1125 North Arsenal Ave., Indianapolis, Ind.

MCREYNOLDS, JOHN WORTH (Jun. '35), With State Highway Dept., Bolivar, Mo.

MADSEN, LYMAN WINN (Jun. '35), 430 East A, Moscow, Idaho.

MARCHETTI, ALDO (Jun. '35), 4110 Ninety-Seventh Pl., Corona, N.Y.

MATTHEWS, ALEXANDER, JR. (Jun. '35), 54–19 Ninety-Fourth St., Elmhurst, N.Y.

MELVILLE, CYRIL GLENNON (M. '35), Engr. of Constr., Modjeski, Masters & Case, Inc., Station F, Box 4036, New Orleans, La.

MERCHANT, GEORGE BRITE (M. '35), Chf. Engr.-Gen. Supt., Andrews-Collings Asphalt Co., Inc., 13th and St. Louis Sts., Louisville, Ky.

MITCHELHILL, JAMES MOFFAT (Jun. '35), 618½ Sheridan Rd., Evanston, Ill.

NELSON, GEORGE ALBERT (Jun. '35), Aeronautical Engr., Ben O. Howard, 5234 Woodlawn Ave., Chicago, Ill.

NIXON, EAGER WOOLDRIDGE (Jun. '35), 4484 West Pine, St. Louis, Mo.

NUSSBAUM, JOSEPH RANDALL (Jun. '35), 72 South Lincoln St., Denver, Colo.

O'NEALL, ALBERT ELLIS (Jun. '35), With Muskingum Watershed Conservancy Dist., 411 North Broadway, New Philadelphia, Ohio.

OSTERLUND, ARNOLD CHARLES, JR. (Jun. '35), 352 Lookout Ave., Hackensack, N.J.

OVERTON, ELTING FILLMORE (Jun. '35), Ridge Terrace, West Caldwell, N.J.

OWENS, PARRY WILLIAM (Jun. '35), 933 Sixteenth Ave., South, St. Petersburg, Fla.

PERRY, FRANCIS EDWARD (Assoc. M. '35), Asst. County Engr., Worcester County (Res., 154 Lovell St.), Worcester, Mass.

PITTEL, HARRY LOUIS (Jun. '35), Asst. Engr., TERA, Project 11-A-Section 2; 228 South 9th St., Brooklyn, N.Y.

POWELL, CARL WILLIAM (Jun. '35), Draftsman, State Highway Comm., 1016 First St., West Lafayette, Ind.

PRAHL, CHARLES GEORGE (Jun. '35), Rodman, U. S. Bureau of Reclamation, Box 87, Coulee Dam, Wash.

RAMSEIER, ROY EDWIN (Jun. '35), Draftsman, Alameda County Mosquito Abatement, Oakland (Res., 2628 Durant Ave., Berkeley), Calif.

REDMILE, HAROLD FRANKLIN (Jun. '35), 2507 Monroe St., Wilmington, Del.

RIDER, EDWIN BURTON (Assoc. M. '35), State Safety Representative, WPA of Maryland (Res., 4912 Alhambra Ave. Govans), Baltimore, Md.

ROWLEY, FLOYD RAYMOND (Jun. '35), Junior Engr., Standard Oil Co. of California, Civ. Eng. Dept., San Francisco (Res., 389 North K St., Livermore), Calif.

RUSSI, ROBERT WILSON (Jun. '35), Care, United Production Co., Beeville, Tex.

SCHLEITER, HOWARD WILLIAM (Jun. '35), 1655 Van Buren St., St. Paul, Minn.

SILBERMAN, EDWARD (Jun. '35), 1101 James Ave., North, Minneapolis, Minn.

SINACORI, MARIANO NICHOLAS (Jun. '35), With TVA Hydr. Laboratory, Box 530, Norris, Tenn.

SPATH, PAUL CHRISTIAN (Jun. '35), Care TVA Eng. Data Div., Union Bldg., Knoxville, Tenn.

STIRTON, JOHN ARTHUR (Jun. '35), 607 West 136th St., New York, N.Y.

SUMRALL, CLINTON LAFAYETTE, JR. (Jun. '35), ECW Headquarters, Holly Springs, Miss.

SWEETON, ARTHUR WATSON, 3d (Jun. '35), Collinsville, Conn.

TAFEL, LOUIS OLIVER (Jun. '35), 762 Hazelwood Ave., Pittsburgh, Pa.

TAYLOR, LESLIE SEYMOUR (Jun. '35), Box 132, Beachwood, N.J.

TCHERNOWITZ, JACK KALMAN (Jun. '35), 1560 Grand Concourse, New York, N.Y.

TEMPEST, JOHN HENRY (Assoc. M. '35), Contr. (Mullins & Wheeler), (Res., 566 East 6th South St.), Salt Lake City, Utah.

TURKEN, MORRIS WILLIAM (Jun. '35), Care, H. J. Welsh, Sikeston, Mo.

TWIGG, OLIVER CHARLES (Jun. '35), 6324 Camden St., Oakland, Calif.

VAN HORN, HAROLD LEROY (Jun. '35), 205 South Grant St., West Lafayette, Ind.

WASHINGTON, COURTENAY CLEVELAND (M. '35), County Engr. and County Surv., Galveston County (Res., 3615 Ave. P ½), Galveston, Tex.

WASSON, MAURICE WAYNE, JR. (Jun. '35), 47 East High St., Union City, Pa.

WEBSTER, MARVIN JAMES (Jun. '35), Surveyman and Junior Engr., U. S. Engr. Office (Res., 521 Melrose Court), Iowa City, Iowa.

WEINKAUFF, WILLIAM CHRISTIAN (Jun. '35), Recorder, U. S. Coast and Geodetic Survey, Washington, D.C. (Res., 7740 Seventy-Ninth Pl., Glendale, N.Y.)

WEISSER, GEORGE ALBERT (Jun. '35), 515 South Adams, Fort Worth, Tex.

WINTERS, ROBERT JOHN, JR. (Jun. '35), 189 Shepard Ave., East Orange, N.J.

WOO, CHESTER (Jun. '35), 716 East Adams St., Los Angeles, Calif.

WOODWARD, RICHARD LEWIS (Jun. '35), Care, Bureau of Public Roads, Box 857, Hot Springs National Park, Ark. (Res., 416 Hereford Ave., Ferguson, Mo.)

YODER, CHARLES WILLIAM (Jun. '35), Asst. Engr., Operating Dept., Pennsylvania Shipping Co., 260 South Broad St. (Res., 2052 South 57th St.), Philadelphia, Pa.

ZEBROSKI, JOHN HOWARD (Jun. '35), Box 534, Babylon, N.Y.

ZIMMERMAN, ALFRED HARVEY (Jun. '35), 711 South 1st St., Lufkin, Tex.

MEMBERSHIP TRANSFERS

ALVORD, JOHN WATSON (M. '93; Hon. M. '35), Cons. Engr. (Alvord, Burdick & Howson), Suite 1401 Civic Opera Bldg., Chicago, Ill.

BOGGS, WALLACE BRADFORD (Assoc. M. '25; M. '35), Chf. Engr., Broadway Low-Level Tunnel Project, Joint Highway Dist. No. 13, 1448 Webster St., Oakland, Calif.

BONNEY, GUY (Assoc. M. '19; M. '35), Res. Engr. Insp., PWA, Frostburg, Md.

BROWNLEE, JAMES LAWRENCE (Assoc. M. '11; M. '35), Regional Engr., U. S. Forest Service (Res., 3436 Clay St.), Denver, Colo.

COLEMAN, JOHN FRANCIS (Past-President). (M. '01; Hon. M. '35), Cons. Engr. (J. F. Coleman Eng. Co.), 1013 Carondelet Bldg., New Orleans, La.

COOLEY, MORTIMER ELWYN (M. '11; Hon. M. '35), Dean Emeritus, Colleges of Eng. and Architecture, Univ. of Michigan; State Engr., PWA, 1010 Fisher Bldg., Detroit (Res., 1405 Hill St., Ann Arbor), Mich.

CORWIN, THORNTON JOHNSON, JR. (Jun. '23; Assoc. M. '26; M. '35), Asst. Engr., Pacific Gas & Elec. Co., 245 Market St., Room 1128, San Francisco, Calif.

COX, GLEN NELSON (Jun. '28; Assoc. M., '35), Associate Prof., Depts. of Civ. Eng. and Eng. Mechanics, Louisiana State Univ., Baton Rouge, La.

COX, MOSES EUGENE (Assoc. M. '29; M. '35), Cons. Engr., 619 Sycamore St., Decatur, Ga.

CUMMINGS, ROBERT AUGUSTUS, JR., (Jun. '17; Assoc. M. '25; M. '35), Appraisal Engr. and Staff Adjuster, Phoenix Assurance Co., Ltd., Boston (Res., 185 Franklin St., Newton), Mass.

DE WESTFELT, GERARD PHILIP (Jun. '31; Assoc. M. '35), 328 East 71st St., New York, N.Y.

EDSTRAND, JOHN PHILIP (Jun. '32; Assoc. M. '35), Asst. Hydr. Engr., U. S. Engr. Office, Missouri River Div., 610 Postal Telegraph Bldg., Kansas City, Mo.

EICKELBERG, ERNEST WERNER (Assoc. M. '21, M. '35), Asst. Chf., Div. of Terrestrial Magnetism and Seismology, U. S. Coast and Geodetic Survey, Washington, D.C.

GALVIN, CHARLES BROE (Assoc. M. '26; M. '35), Div. Engr., Dept. of Docks, City of New York, Pier A, North River (Res., 467 Central Park West), New York, N.Y.

GITTLESON, IRVIN (Jun. '33; Assoc. M. '35), Draftsman, Ash, Howard, Needles & Tammen (Res., 2825 Webb Ave.), New York, N.Y.

HARTMANN, ERNEST CHRISTIAN (Jun. '27; Assoc. M. '35), Research Engr., Aluminum Co. of America (Res., 1025 Manor Rd.), New Kensington, Pa.

HICKOX, GEORGE HAROLD (Jun., '26; Assoc. M. '35), Associate Hydr. Engr., TVA, Hydraulic Laboratory, Norris, Tenn.

HOHLWEG, WILLIAM AUGUST (Jun. '24; Assoc. M. '35), Mountain Lake Park, Md.

HUGHES, MELVIN MARK (Jun. '32; Assoc. M. '35), Supt. SCS, Camp 27, Marion, Ill.

KNAPIK, EDWARD MATHIAS (Jun. '23; Assoc. M. '26; M. '35), Associated with W. L. Huber, 1325 Crocker First National Bank Bldg., San Francisco (Res., 252 Mather St., Oakland), Calif.

LEISTER, JOHN SWIVEL (Assoc. M. '24, M. '35), Asst. Prof., Civ. Eng., Univ. of Alabama, Box 2051, University, Ala.

McCANDLISS, LESTER CHIPMAN (Assoc. M. '16; M. '35), Prof. and Head of Dept. of Civ. Eng., Univ. of Pittsburgh, Pittsburgh, Pa.

McCASHIN, CLARENCE EUGENE (Assoc. M. '26; M. '35), Dist. Engr., U. S. Geological Survey, Room 217, Post Office Bldg., Chattanooga, Tenn.

MANN, RALPH HASSLER (Assoc. M. '23; M. '35), New York (Eastern) Representative, Am. Wood-Preservers' Assoc., 292 Madison Ave., New York, N.Y.

NAVE, HORACE GREELEY (Jun. '29; Assoc. M. '35), Eng. Aide, TVA, Box 133, La Follette, Tenn.

PEIRCE, WALTER ANDERSON (Assoc. M. '23; M. '35), Mgr., Racine Water Dept., City Hall (Res., 2335 Carmel Ave.), Racine, Wis.

PHILLIPS, MARION EDGAR (Jun. '33; Assoc. M. '35), Chf. of Party (Eng.) U. S. Biological Survey Dept. of Agriculture, Box 55, Puxico, Mo.

ROSSELL, FRANCIS ALOYSIUS (Assoc. M. '23; M. '35), Cons. Engr., 103 Waverly Pl., New York, N.Y.

SCHMIDT, EDWARD CARL (Jun. '25; Assoc. M. '35), Engr., Works Div., TERA, New York (Res., 258 Argyle Rd., Brooklyn), N.Y.

SCHOFER, AUGUST (Jun. '28; Assoc. M. '35), Attorney-at-Law; Asst. Highway Engr., Bureau of Public Roads, 85 East Gay St. (Res., 868 Sheridan Ave.), Columbus, Ohio.

SETTE, FRANCIS JOSEPH (Assoc. M. '26; M. '35), Stoneleigh Court, 1025 Connecticut Ave., N.W., Apartment 301, Washington, D.C.

SMITH, CHARLES FRANCIS (Jun. '26; Assoc. M. '35), Engr., Standard Oil Co. of Indiana (Res., 907 South Lincoln), Casper, Wyo.

SMOCK, WILLIAM FRANKLIN (Jun. '24; Assoc. M. '35), 2119 Quintard Ave., Anniston, Ala.

SORKIN, JOSEF (Jun. '29; Assoc. M. '35), Bridge Designer, State Highway Comm. (Res., 518 Dearborn Ave.), Helena, Mont.

TAYLOR, JAMES ELLIOTT (Jun. '34; Assoc. M. '35), Res. Engr., State Highway Dept., Box 626, Post, Tex.

VARDERO, ANTHONY WILLIAM (Jun. '30; Assoc. M. '35), 1030 Federal St., Philadelphia, Pa.

WILGUS, WILLIAM JOHN (M. '96; Hon. M. '35), Cons. Engr., Ascutney, Vt.

YOUNG, DANA (Jun. '26; Assoc. M. '35), Asst. Prof. of Eng., Connecticut State Coll., Storrs, Conn.

REINSTATEMENTS

BONNER, DAVID, M., reinstated Oct. 24, 1935.

CONWAY, NORMAN BUTLER, M., reinstated Oct. 14, 1935.

FERTIK, JOSEPH, Assoc. M., reinstated Oct. 9, 1935.

HANCOCK, WILLIAM GAW, Assoc. M., reinstated Nov. 1, 1935.

REHLER, JOSEPH EDWARD, Jun., reinstated Oct. 17, 1935.

SHAW, CHARLES, Assoc. M., reinstated Oct. 21, 1935.

SMITH, ARTHUR RICHARDS, M., reinstated Nov. 6, 1935.

WHEATLEY, WALTER HANNUM, Assoc. M., reinstated Oct. 16, 1935.

WHITTELSEY, CHARLES CHAUNCEY, Assoc. M., reinstated Oct. 16, 1935.

WYMAN, ALFRED MARSHALL, JR., Jun., reinstated Nov. 7, 1935.

RESIGNATIONS

GREEN, WILLIAM EDWARD, Jun., resigned Nov. 1, 1935.

HARTUNG, HERBERT OTTO, Jun., resigned Nov. 1, 1935.

WHITEHOUSE, SAMUEL CEDRIC, Jun., resigned Oct. 22, 1935.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment of Members to Board of Direction

December 1, 1935 NUMBER 12

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years*	5 years of important work
Associate Member	Qualified to direct work	27 years	8 years*	1 year
Junior	Qualified for sub-professional work	20 years †	4 years*	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years*	5 years of important work
Fellow	Contributor to the permanent funds of the Society			

* Graduation from an engineering school of recognized reputation is equivalent to 4 years of active practice.

† Membership ceases at age of 33 unless transferred to higher grade.

The fact that applicants refer to certain members does not necessarily mean that such members endorse.

FOR ADMISSION

ALLIN, RALPH WALTER, Pasadena, Calif. (Age 32.) Member, Hydrographic Div., Pasadena Water Dept. Refers to S. B. Morris, V. L. Peugh, C. W. Sopp, O. A. Stone, I. L. Tyler, K. Q. Volk, R. White.

ALVANOPOULOS, JOHN STAVRON, Komotini, Greece. (Age 25.) Asst. Engr. to Director of Public Works of Thrace and Eastern Macedonia. Refers to H. Bouchard, H. W. King, R. L. Morrison, C. O. Wisler, J. S. Worley.

ANDERSON, MILTON, North Hollywood, Calif. (Age 40.) Jun. Civ. Engr., Bureau of Water Works and Supply, Los Angeles, Calif. Refers to E. A. Bayley, S. A. Evans, W. W. Hurlbut, S. B. S. Nelson, J. E. Phillips, R. R. Proctor, H. A. Van Norman, W. W. Wyckoff.

BROECKER, CLETUS ANDREW, Indianapolis, Ind. (Age 28.) With Bureau of Materials and Tests, State Highway Comm. of Indiana. Refers to G. H. Allen, F. Kellam, W. A. Knapp, H. S. Morse, W. B. Wendt, J. W. Wheeler, R. B. Wiley.

BROWN, WILLIAM ISAAC, Denver, Colo. (Age 34.) Asst. Engr., U. S. Bureau of Reclamation. Refers to W. H. Barton, Jr., R. M. Beck, H. C. Berry, W. E. Brown, H. A. Cotton, C. L. Eckel, N. C. Holdredge, D. W. Howes, A. W. Kidder, W. S. Pardoe, C. P. P. Vetter, J. A. Ward.

CANNELL, PAUL JOHN, Lincoln, Nebr. (Age 44.) Highway Bridge Designer, Bridge Dept., Nebraska Bureau of Roads and Bridges. Refers to O. W. Childs, H. C. Ford, N. W. Funk, W. Grant, R. M. Green, E. Y. Grupe, Jr., H. D.

Jolley, N. J. Lomax, J. W. McCullough, J. G. Mason, C. C. Nicholls, A. L. Ogle, K. E. Vogel.

CARTER, ARCHIE NEWTON, Rock Island, Ill. (Age 25.) Jun. Engr., Design Sec., Rock Island Dist. Office, War Dept. Refers to A. H. Holt, J. W. Howe, B. J. Lambert, F. T. Mavis, E. E. Moots, C. C. Williams.

COLE, HOWARD THOMAS, Atlanta, Ga. (Age 46.) State Engr. Inspector for Alabama, Georgia and Florida PWA. Refers to J. W. Barnett, L. F. Bellinger, L. S. Dixon, H. W. Durham, A. A. Fries, J. H. Johnston, J. S. Langthorn, M. J. Macnabb, W. S. McDonald, F. E. Schnepfe, C. D. Vassar, H. F. Wiedeman.

DE PETRA, THOMAS JOSEPH JULIUS, New York City. (Age 29.) Refers to I. J. Lake, E. Pittarelli.

DOUMA, JACOB HENDRICK, Vicksburg, Miss. (Age 23.) Gauge Reader, Mississippi River Comm. Refers to C. Derleth, Jr., B. A. Etcheverry, S. T. Harding, C. G. Hyde, M. P. O'Brien.

ENNIS, WILLIAM DUANE, Hoboken, N.J. (Age 58.) Alexander Crombie Humphreys Prof. of Economics of Eng., Head of Dept., Stevens Inst. of Technology; also consulting work. Refers to E. P. Goodrich, H. P. Hammond, C. W. Hudson, G. A. Orrok, C. H. Paul, D. L. Snader.

EVERTS, CURTISS MITCHELL, JR., Salt Lake City, Utah. (Age 27.) In charge of Sanitation in Utah for U. S. Public Health Service. Refers to G. H. Bishop, A. M. Erskine, L. E. Grinter, J. M. Jarrett, H. E. Miller, J. H. Rafferty, F. H. Richardson

FAXON, ALFRED AUSTIN, JR., Trenton, N.J. (Age 28.) Jun. Engr., New Jersey State Highway Dept. Refers to E. K. Bryant, W. J. Carroll, F. C. Claus, J. Logan, J. J. Manning, E. W. Packer, J. A. Williams.

FRAGA, GEORGE PABLO, Brooklyn, N.Y. (Age 21.) Asst. Estimator, North Eastern Constr. Co. Refers to L. W. Clark, T. R. Lawson.

GARCIA MONTES, JOSE, Havana, Cuba. (Age 42.) Chf. Designing Engr., Havana Water Works. Refers to E. J. Chibas, J. A. Cosculluela y Barreras, C. C. FitzGerald, F. J. Gaston, A. Potter, N. M. Rivero y Mahy, R. V. Sorondo, P. A. Suarez y Cordoves, M. Villa Rivera, E. R. Williams.

GERARDI, JASPER, Detroit, Mich. (Age 29.) Instructor in Surveying and Eng. Drawing, Univ. of Detroit. Refers to L. C. Maugh, C. J. J. Pajot, W. C. Sadler, R. H. Sherlock, J. A. Van den Broek.

HACKSTAFF, FRANK BLAISDELL, Red Bank, N.J. (Age 24.) Chf. Draftsman, U. S. Coast and Geodetic Survey and State Survey, Princeton, N.J. Refers to E. N. Burrows, J. F. W. Gebhardt, P. Kissam, E. Pendlebury, J. E. Perry.

HEARD, GARLAND WILSON, Ripley, Miss. (Age 23.) County Engr., Tippah County Board of Supervisors. Refers to C. E. Downing, A. B. Hargis.

JACOBS, ISMAEL LEONARD, Brooklyn, N.Y. (Age 63.) Refers to C. C. Armstrong, B. A. Bakhmeteff, G. M. Purver, E. E. Wissotsky, M. M. Zolotareff.

JORISSEN, ANDRE LAURENT, Cambridge, Mass. (Age 22.) Graduate student, Massachusetts Inst. of Technology. Refers to H. K. Barrows, C. B. Breed, W. M. Fife, K. C. Reynolds.

JUNIOR, FRANCIS EDMUND, Knoxville, Tenn. (Age 34.) Associate Highway Engr., TVA, Highway Sec. Refers to J. W. Bradner, Jr., W. N. Brown, G. D. Kennedy, J. R. Pollock, A. J. Trapp, G. D. Whitmore.

KOZLOWSKI, EDWARD, Chicago, Ill. (Age 30.) Instructor in Civ. Eng., Lewis Inst. Refers to J. G. Bennett, H. F. Gonnerman.

KRIDEL, BENJAMIN, New York City. (Age 42.) Res. Engr. Inspector for FAPW, on Midtown Hudson Tunnel, New York side. Refers to W. M Griffin, H. L. King, J. J. Nanry, J. H. Quimby, L. E. Robbe, J. B. Snow.

KURTZNER, FRED WILLIAM, Cleveland, Ohio. (Age 24.) Refers to G. E. Barnes, G. B. Barnest, F. L. Plummer, W. E. Rice, G. B. Sowers.

LEFEVRE, WILLIAM DOUGLAS, Chesapeake City, Md. (Age 41.) Chf. Inspector, Kent Island Bridge. Refers to C. B. Bryant, C. P. Comegys, R. M. Reindollar, L. Schaidt, A. F. Shure.

LESLIE, DANA DALE, Fargo, N.Dak. (Age 26.) Instructor in Civ. Eng., North Dakota State Coll. Refers to A. Haertlein, F. L. Plummer.

MARCHANT, ORSON HILL, New Haven, Conn. (Age 53.) Vice-Pres., Secy. and Engr., Blair & Marchant, Inc., Civ. Engrs. and Surveyors. Refers to C. Blakeslee, E. E. Minor, E. M. T. Ryder, W. J. Scott, S. P. Senior, J. P. Wadhams.

MARSCHAL, PAUL, Dunnellon, Fla. (Age 40.) Project Engr., State Road Dept. of Fla., Tallahassee, Fla. Refers to R. E. Hardaway, Jr., J. W. Leroux, W. I. Nolen, G. G. Thomas, J. E. Willoughby.

MARTIN, FRANK LYSANDER, Chester, Pa. (Age 53.) Prof. of Civ. Eng., also Head, Dept. of Eng., Pennsylvania Military Coll. Refers to W. H. Barton, Jr., H. C. Berry, A. J. Boase, L. L. Lessig, W. I. Lex, C. E. Myers.

MARTIN, RANDOLPH LEE ARTHUR, Pittsburgh, Pa. (Age 27.) Inspector, U. S. Engr. Office. Refers to N. W. Bowden, A. Diefendorf, W. L. Kuehnle, L. C. McCandliss, P. A. Perrin.

MORGAN, JOHN DWIGHT, Dallas, Tex. (Age 31.) Senior Estimator, WPA, Dist. No. 4, Texas. Refers to J. T. Conroy, G. E. Franklin, J. T. L. McNew, E. L. Myers, E. N. Noyes, R. B. Thomas.

NERDAHL, LOVAL MELVIN, Ithaca, N.Y. (Age 26.) Miscellaneous Constr. Foreman, U. S. Dept. of Interior, ECW. Refers to R. W. Chase, C. Crandall, P. S. Monk, L. C. Urquhart.

PARRISH, ARTHUR DANIEL, JR., New York City. (Age 25.) Refers to R. E. Goodwin, F. O. X. McLoughlin, J. C. Rathbun.

PEACHEY, ROBERT ANTHON, Coytesville, N.J. (Age 28.) Engr., Allison Land Co.–Harry J. Schnell, Trustee, South Orange N.J. Refers to A. F. Eschenfelder, G. R. Hartley, H. W. Heilmann, J. W. Heller, M. Hendee.

PENN, JOHN CORNELIUS, Chicago, Ill. (Age 54.) Director of Civ. Eng. Option, Armour Inst. of Technology. Refers to J. F. Mangold, G. L. Opper, H. Penn, C. S. Rowe, R. L. Stevens, T. F. Wolfe.

PEPPERMAN, CECIL MALLORY, South Williamsport, Pa. (Age 28.) Draftsman, Pennsylvania Dept. of Highways (acting as Senior Draftsman and Inspector). Refers to J. P. Ambler, M. J. Barrick A. E. Farrington, S. W. Jackson, J. S. Ritchey, H. R. Thayer.

PETRULLO, CARL FRANK, Northumberland, Pa. (Age 23.) Refers to D. M. Griffith, W. Whited.

PFEFFER, JOSEPH, Genoa, Wis. (Age 24.) With U. S. Army Engrs. at Dam No. 8. Refers to L. V. Carpenter, T. Saville, C. T. Schwarze, D. S. Trowbridge, S. P. Yasinos.

RICH, LOWELL REDD, Gallup, N.Mex. (Age 26.) Project Engr., Mexican Springs Experiment Station, Soil Conservation Service. Refers to G. D. Clyde, B. A. Etcheverry, G. P. T. Howell, H. R. Kepner, R. B. West.

ROGERS, FRANKLYN CHRISTOPHER, Harrington Park, N.J. (Age 25.) Draftsman and Designer, Ambursen Dam Co., New York City. Refers to E. H. Burroughs, Jr., C. V. Davis, W. K. Hatt, W. J. Henderson, S. C. Hollister, W. E. Howland, J. H. Matthews.

ROSENGARTEN, CARL ALFRED, Brookline, Pa. (Age 32.) Structural Engr., The Ballinger Co., Archts. & Engrs., Philadelphia, Pa. Refers to H. C. Berry, C. de Moll, J. J. Grelis, Jr., R. W. Hoch, S. Smith, F. P. Witmer.

SEAMAN, AMBROSE CLEAVER, Flushing, N.Y. (Age 34.) Engr., B. H. Constr. Co., Woodside, N.Y. Refers to L. T. Alden, A. Alexander, R. Eberlin, R. Schermerhorn, Jr., L. S. Stiles.

SMITH, LAWRENCE WESLEY, Washington, D.C. (Age 38.) Forest Products Engr., National Lumber Mfrs. Association. Refers to H. N. Benkert, F. J. Hanrahan, A. C. Horner, L. P. Keith, P. T. Landsem, E. D. Walker.

STEWART, LUTHER WASHINGTON, Greenville, Miss. (Age 43.) Asst. County Highway Engr., Washington County. Refers to J. S. Allen, H. C. Dietzer, W. E. Elam, R. A. Harris, R. F. Rudolph, E. U. Stevenson, C. Woodfin.

STINSON, ORVIS DANIEL, Raleigh, N.C. (Age 27.) Transitman, State Highway Comm. Refers to H. G. Baity, T. F. Hickerson, T. Saville, R. M. Trimble.

STUBBINS, LEWIS CLARK, Los Angeles, Calif. (Age 57.) Res. Engr. Inspector, FEA of PW. Refers to O. E. Carr, H. T. Cory, H. W. Dennis, H. L. Haehl, R. B. Ketchum, H. A. Van Norman.

THOM, PAUL GEORGE, LaFollette, Tenn. (Age 22.) Under Eng. Aide, Eng. Service Div., TVA. Refers to G. E. Barnes, M. S. Douglas, G. B. Earnest, F. L. Plummer.

TOWNSEND, GEORGE ELLSWORTH, Chattanooga, Tenn. (Age 23.) Asst. Eng. Draftsman, TVA. Refers to E. F. Berry, E. F. Church, L. Mitchell, S. D. Sarason.

VENNARD, JOHN KING, New York City. (Age 26.) Instructor in Hydraulics, New York Univ. Refers to J. B. Babcock, 3d, H. K. Barrows, L. V. Carpenter, K. C. Reynolds, T. Saville, C. M. Spofford.

WEAKLEY, SAMUEL ANDERSON, Nashville, Tenn. (Age 48.) Engr., U. S. Engr. Office. Refers to J. F. Brookes, H. C. Fiske, H. A. Hickman, H. B. Hooper, F. J. Lewis, M. S. Long, W. S. Winn.

WEED, SAM ALLEN, Berkeley, Calif. (Age 30.) With Eng. Dept., City of Oakland, Calif. Refers to S. T. Harding, C. G. Hyde.

WHITTAKER, JOHN DEAN, Chu Chua, B. C. Canada. (Age 23.) Surveyor, Windpass Gold Mining Co., Ltd., Boulder, B.C., Canada. Refers to E. A. Cleveland, A. H. Finlay, J. R. Grant, E. G. Matheson.

WILLEY, CHARLES KEITH, Topeka, Kans. (Age 24.) Draftsman, Design Dept., Kansas State Highway Comm. Refers to O. J. Eidmann, J. O. Jones, W. C. McNown, F. A. Russell.

WILLIAMS, ROBERT EDMOND, Oakland, Calif. (Age 22.) Refers to C. Derleth, Jr., F. S. Foote, C. G. Hyde, W. H. Popert.

WISHART, JOSEPH TIERNEY, Freeport, N.Y (Age 43.) Asst. Engr., Dept. of County Engr. Mineola, N.Y. Refers to S. B. Bowne, I. E. Behrman, J. C. N. Guibert, G. H. Peters, E. F. Preece, W. F. Starks.

YOUNG, TRUMAN PADDACK, Cincinnati, Ohio. (Age 37.) Structural Engr. for City of Cincinnati. Refers to A. C. Copland, P. Jones, V. B. W. Poulsen, J. E. Root, H. M. Waite.

FOR TRANSFER

FROM THE GRADE OF ASSOCIATE MEMBER

MAYER, EDWARD BROMLEY, Assoc. M., Los Angeles, Calif. (Elected April 18, 1927.) (Age 45.) With Bureau of Water Works and Supply. Refers to W. W. Hurlbut, H. L. Jacques, D. A. Lane, J. E. Phillips, R. R. Proctor, H. A. Van Norman.

RIVERO, JUAN RAMON, Assoc. M., La Paz, Bolivia. (Elected Aug. 31, 1925.) (Age 39.) Chf. Engr., Railways and Air Transport, Dept. of Public Works of Bolivia. Refers to E. Aranibar, W. L. Milner, C. Tejada Sorzano.

(Applies in accordance with Sec. 1, Art. I, of the By-Laws.)

SANDS, ROBERT LAWRENCE, Assoc. M., Floral Park, N.Y. (Elected Oct. 12, 1925.) (Age 40.) Asst. Engr., New York Edison Co., New York City. Refers to F. D. Hutchinson, G. J. Meise, G. A. Orrok, C. M. Pinckney, E. M. Van Norden.

FROM THE GRADE OF JUNIOR

ADAMS, RAY, Jun., Jefferson City, Mo. (Elected Oct. 10, 1927.) (Age 32.) With Bureau of Bridges, Missouri Highway Comm. Refers to W. N. Adams, C. W. Brown, L. E. Conrad, F. W. Harvey, S. M. Rudder.

BRYANS, CLYDE VENROY, Jun., Phoenix, Ariz. (Elected Dec. 22, 1930.) (Age 32.) Road Engr., U. S. Indian Service. Refers to C. C. Fishburn, J. R. Lapham, J. L. Nagle, R. H. A. Rupkey, A. K. Vickery.

JOHNSON, ARTHUR, Jun., Tacoma, Wash. (Elected July 6, 1925.) (Age 32.) Associate Engr., Conservation Branch, Power Sec., U. S. Geological Survey, Washington, D.C. Refers to A. L. Alin, C. J. Bartholet, L. L. Bryan, G. H. Canfield, E. F. Chandler, H. H. Hodgeson, W. G. Hoyt, B. E. Jones, T. R. Newell, G. L. Parker, H. Stabler, A. J. Turner.

KIMBALL, WILLIAM PHELPS, Jun., Hanover, N.H. (Elected Nov. 11, 1929.) (Age 30.) Asst. Prof. of Civ. Eng., Thayer School of Civil Eng. Refers to R. Fletcher, F. W. Garran, O. E. Hovey, W. H. Kimball, D. E. Moran, C. S. Proctor, A. P. Richmond, Jr.

KING, DONALD DOMINICK, Jun., Forest Hills, N.Y. (Elected Nov. 10, 1930.) (Age 28.) With American Society of Civil Engineers, New York City. Refers to C. E. Beam, H. P. Eddy, A. H. Fuller, R. H. Mann, J. C. Rathbun, R. J. Reed, H. J. Sherman.

LEWIS, WILLIAM WHITFIELD, Jun., Durham, N.C. (Elected July 23, 1934.) (Age 27.) Instructor in Civ. Eng., Duke Univ. Refers to L. R. Ames, H. C. Bird, P. A. Franklin, W. H. Hall, H. O. Hill.

LOUREE, CHARLES HAROLD, Jun., Tulsa, Okla. (Elected Oct. 30, 1933.) (Age 32.) With Stanolind Oil & Gas Co. Refers to V. H. Cochrane, R. L. Ehrlich, R. P. Garrett, A. Lewald, J. B. Neely, D. W. Patton, C. Schultz.

MCLAUGHLIN, EDWARD DENNIS, Jun., Hopewell, Va. (Elected June 4, 1928.) (Age 32.) Designer and Checker (being Asst. to Squad Chf.). The Solvay Process Co. Refers to E. H. Cameron, G. F. Devereux, P. E. Gisiger, B. W. Guppy, P. Jones, L. K. Maires, A. Maltman.

RICE, CLAUDE HAYES, Jun., Peru, Vt. (Elected Oct. 24, 1932.) (Age 31.) Project Supt., U. S. Forest Service. Refers to J. B. Babcock, 3d, C. B. Breed, J. C. Dort, H. T. Livingston, C. M. Spofford.

SEELY, GEORGE HERMAN, Jun., Maracaibo, Venezuela. (Elected Oct. 10, 1927.) (Age 32.) Engr., Lago Petroleum Corporation. Refers to J. J. Collins, W. V. McMenimen, J. W. Taussig, H. E. Weatherlow, R. R. Wiggins.

SELBY, CHARLES ARTHUR, Jun., New York City. (Elected Dec. 22, 1930.) (Age 28.) Secy. and Treas., Wininger & Selby, Inc. Refers to A. T. Glassett, C. H. Higginson, R. I. Land, H. T. Larsen, D. T. Webster.

TOLANDER, ARTHUR WILLIAM, Jun., Caripito, Venezuela. (Elected Oct. 1, 1926.) (Age 32.) Engr. (Field Engr.), Standard Oil Co. of Venezuela. Refers to A. W. Green, Jr., H. H. Hatch, T. Human, Jr., R. Kleppe, A. V. Lynn, B. Rasmussen, R. R. Wiggins.

VOIGT, PAUL ALEXANDER, Jun., Woodhaven, N.Y. (Elected March 5, 1928.) (Age 32.) Asst. to Chf. Engr., Bldg. Materials Dept., Johns-Manville Corporation, New York City. Refers to F. T. Brown, C. L. Day, H. L. Rogers, C. O. Skinner, R. R. Waddington.

WALLIN, CARL JORGAN, Jun., Hot Springs, Va. (Elected March 11, 1929.) (Age 32.) Chf. Engr., Virginia Hot Springs Co. Refers to W. E. Brackett, H. M. Church, W. J. Mathews, Jr., R. Messer, R. H. Patterson.

WESTBY, HARVEY ORLANDO, Jun., Portland, Ore. (Elected April 18, 1927.) (Age 32.) Prin. Eng. Draftsman, U. S. Engr. Dept. Refers to E. F. Chandler, A. J. Gilardi, C. I. Grimm, F. H. Hardy, R. E. Mackenzie, O. A. Piper, J. C. Stevens.

WINTZ, EDWARD RAMSEY, Jun., Riverside, Calif. (Elected Nov. 26, 1934.) (Age 32.) With Metropolitan Water Dist. of Southern Calif. Refers to J. B. Bond, J. L. Burkholder, R. B. Diemer, J. Munn, O. J. Schieber, N. D. Smith, R. Stephens, Jr.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1935 Year Book of the Society. To expedite publication, notices, should be sent direct to the Employment Service, 31 West 39th Street, New York, N. Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

CONSTRUCTION

MATERIALS ENGINEER OR CONCRETE TECHNICIAN; Assoc. M. Am. Soc. C.E.; Member American Society of Testing Materials; Member American Concrete Institute; technical education; 10 years on construction—6 in charge of testing construction materials. Experienced particularly in supervising concrete tests and investigations and preparing reports; several papers published. C-8022.

DESIGN

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; licensed professional engineer, New York State; 35; married; A.B., Fordham; B.S. in C.E., Manhattan College; 9 years experience in engineering, including detailing structural steel and iron; designing, drafting, estimating, surveying, and supervising various types of construction. Desires clerical or engineering position one or more evenings a week. C-6554.

EXECUTIVE

CIVIL ENGINEER; M. Am. Soc. C.E.; age 41; now available; civil engineering graduate, Massachusetts Institute of Technology; 11 years experience as foreman, superintendent, or construction engineer on sewers, tunnels, subways, harbor work, earthwork, surveys; 3 years stadia; some knowledge steam and refrigeration. D-4227.

EXECUTIVE; M. Am. Soc. C.E.; graduate structural engineer; New York, Illinois, and California license; 20 years with present associates. Structural designer, estimator, and supervising engineer in charge of designing and drafting offices on industrial plants and facilities, railway shops and terminal structures, power houses and substations, and special structures. Available on short notice to go anywhere. D-4320.

EXECUTIVE; M. Am. Soc. C.E.; consulting civil engineer; 55; married; A.B. and M.C.E.; 36 years experience; qualified for responsible supervision and management, private or public work; familiar with all types and phases of engineering activity; accustomed to handling special problems requiring large personnel; free for engagements. Location, West Coast. A-2394.

CIVIL ENGINEER; M. Am. Soc. C.E.; 42; married; 25 years industrial work (bakeries, packing houses, etc.) as office manager, purchasing agent, general superintendent. Desires similar post with architect, engineer, industrial corporation, or as superintendent of public works, or buildings in municipality of 100,000. Eastern seaboard. Would go to England or Canada (connections in both) as sales representative. D-932.

ENGINEER; M. Am. Soc. C.E.; 38; C. E., New York State professional engineer's license. Design and construction of industrial or metallurgical plants. B-5715.

GRADUATE CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; registered in two states; 13 years experience; desires connections; 4 years in supervision and construction of concrete highways and bridges; 5 years in charge of preliminary surveys and plans for municipal improvements; 4 years as construction engineer on large industrial plants, installation of equipment, and preliminary operations. D-1100.

STRUCTURAL ENGINEER; Assoc. M. Am. Soc. C.E.; C. E. graduate, 1923; registered engineer in Pennsylvania; 37; bachelor. Experience in detailing and design of structural steel, bridges, and mill buildings, riveted and welded. Experience on maintenance force. Some surveying. Also experience in heating, ventilating, and sanitary engineering. Available on short notice. Will go anywhere. D-4329.

PATENT ATTORNEY; Assoc. M. Am. Soc. C.E.; registered patent attorney, who is a graduate engineer and member of bar, desires to make change, preferably by forming connection with a corporation to organize and manage its patent department. Has had several years experience with an outstanding patent law firm. Has had 3 years experience with corporation patent departments. B-1819.

EXECUTIVE ENGINEER; M. Am. Soc. C.E.; seeks connection with financial house or engineering concern doing domestic or foreign business. C-9867.

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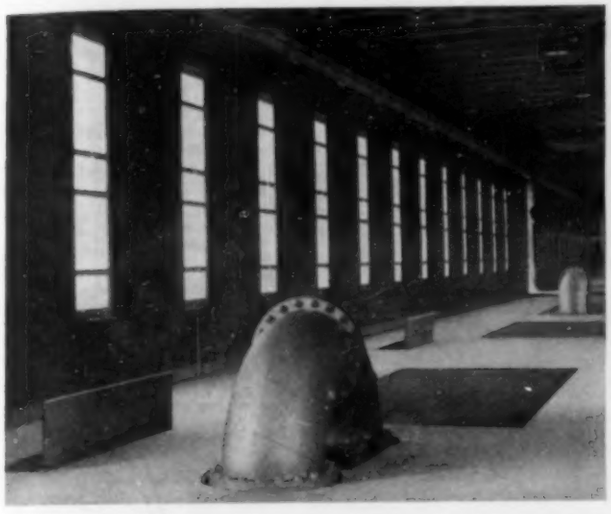

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BRIDGES

CONCRETE, CONSTRUCTION. Study of Job Production on Small Road Bridges, D. V. Purinton. *Eng. News-Rec.*, vol. 113, no. 16, Oct. 18, 1934, pp. 492–494. Man-hour records of pile casting and driving and of concrete production on eight concrete road bridges, indicating that only about 20 per cent of available time was employed in income-producing work.

CONCRETE, FRANCE. Le pont de la Roche-Guyon, J. Allais. *Arts et Métiers*, no. 166, July 1934, pp. 141–143. Design and construction of a concrete-bridge over the Seine River at Roche-Guyon, having a span of 161 m, a rise of 23 m, and a width of 10 m.

CONCRETE, RIGID FRAME. Rigid-Frame Concrete Bridge in Pueblo Style Architecture, W. E. Strohm. *Eng. News-Rec.*, vol. 113, no. 17, Oct. 25, 1934, p. 534. Features of concrete highway bridge, rigid-frame filled spandrel type of barrel design, with a clear span of 50 ft and a total width of 59 ft 10 in.

LIFT, GREAT BRITAIN. Vertical Lift Bridge. *Surveyor*, vol. 86, no. 2216, July 13, 1934, p. 23. New bridge having span of 33 ft, 36 ft wide, constructed at Boyston, England; total cost £10,600; operating equipment; architectural treatment of structure.

MOVABLE. Opening Bridges. *Surveyor*, vol. 86, no. 2220, Aug. 10, 1934, p. 133. Features of several recently completed movable bridges in America, Europe, Asia, and Australia, illustrating recent designs of vertical lift spans, rolling lift spans, bascule (pivoted) spans, and swing bridges.

RIGID FRAME. Symmetrical Rigid Frames, W. H. Weiskopf and J. W. Pickworth. Mimeograph copy published by Inst. Steel Construction. 1934, 19 pp., illus., diagrs., charts, tables. Simple method of analyzing stresses for common case of rigid-frame, symmetrical, single-span bridge; formulas for directly determining horizontal component of reaction; numerical examples.

STEEL, DESIGN. Long Span Bridges, R. Freeman. *Surveyor*, vol. 86, no. 2219, Aug. 3, 1934, pp. 103–104. Types of construction; composite types; improvements in quality of steel; rolling loads; wind pressure. Before Int. Congress Steel Developments.

STEEL, WELDING. Strengthening Railway Bridges by Welding, O. Bondy. *Ry. Engr.* vol. 55, no. 10, Oct. 1934, pp. 313–317. Examples of strengthened German railway bridges selected because of their novel structural features; advantages of welding; extent of strengthening; combined reconditioning and strengthening; welding vs. riveting; examples of reinforcement.

STEEL TRUSS, COMBINED. Highway Traffic Increases Returns for Two Large Railway Bridges. *Ry. Age*, vol. 97, no. 12, Sept. 22, 1934, pp. 336–338. Bridges on New York Central line between Tupper Lake and Ottawa, Ont.; south bridge consists of three Pratt truss spans, each 368 ft long, with 60-ft deck girder approach span at each end; bridge over north channel is cantilever structure with length of 841 ft and swing draw span of 240 ft; simple alteration of structures makes possible important motor route by adapting bridges for vehicle traffic.

STEEL, TRUSS WASHINGTON. Long Steel Bridges Added to Washington Highway System. *Eng. News-Rec.*, vol. 113, no. 17, Oct. 25, 1934, p. 519. Features of through and deck cantilever bridges, from 350 to 550 ft in span, being built at Grant Coulee Dam and over Deception Pass in Puget Sound.

BUILDINGS

APARTMENT HOUSES, WARSAW, POLAND. Welding Used Extensively in Tall Apartment House in Poland, S. Bryla. *Eng. News-Rec.*, vol. 113, no. 17, Oct. 25, 1934, pp. 524–525. Method of welding steel frame of 17-story Prudential House in Warsaw, Poland.

EARTHQUAKE EFFECT. On Vibration of Buildings and Reinforced Concrete Chimneys Due to Earthquake Motion, T. Fukutomi. *Tokyo Imperial Univ.—Earthquake Research Inst.—Bul.*, vol. 12, pt. 3, Sept. 1934, pp. 492–516, 1 supp. plate. Mathematical analysis of observations on damping of high structures in Japan; calibration of earthquake motion; mode of vibration of buildings; application to results of observation of vibration of buildings and chimneys; other phenomena connected with the vibration of buildings. (In English.)

HEAT INSULATION. Heat Insulation as Applied to Buildings and Structures, E. A. Allcut. *Instn. Mech. Engrs.—Advance Paper*, mtg. Nov. 30, 1934, 39 pp. Insulating materials and conditions relating to such temperatures as are likely to be met with in heating, cooling, ventilating, or refrigerating practice; symbols and nomenclature used are those adopted by Committee on Heat Transmission of National Research Council (U.S.A.). Bibliography.

POST OFFICES, AIR CONDITIONING. Conditioned Air and Heat for Washington's New Post Office, R. N. Ward. *Power*, vol. 78, no. 8, Aug. 1934, pp. 440–442. Three systems distribute conditioned air; four methods used to supply heat, diagrams, and illustrations.

CITY AND REGIONAL PLANNING

BUILDINGS. Height and Bulk in Buildings in Relation to Their Requirements and Surroundings, H. V. Lanchester. *Surveyor*, vol. 85, no. 2214, June 29, 1934, pp. 703–704. Density regulations; development formula; rebuilding and traffic demands; road space; inadequate street systems. Before Town Planning Inst.

HOUSING. Housing of Working Classes, F. Hunt. *Surveyor*, vol. 86, no. 2218, July 27, 1934, p. 85. Overcrowding; slum conditions; clearance areas and improvement areas. Before Int. Federation of Surveyors.

ITALY. Il Piano regolatore di Foggia, C. Albertini. *Politecnico*, vol. 82, no. 3, Aug. 1934, pp. 467–480 1 supp. sheet. Description of new regulating plan for ancient city of Foggia in southern Italy.

LYNCHBURG, VA. Lynchburg City Plan Report. Lynchburg, Va., 1934, 17 pp., figs., supp. map. Outline of new regulating plan of city having population of about 42,000.

TENNESSEE. Transforming Tennessee Basin into Vast Testing Ground, C. E. Williams. *Mfrs. Rec.*, vol. 103, no. 10, Oct. 1934, pp.24–28, 70 and 72. Discussion of sociological, conservation, and industrial decentralization program, including hydro-electric power, fertilizer, and other projects; reforestation; control of flood waters and soil erosion; navigation improvement and town building.

CONCRETE

CONSTRUCTION, PRESENT STATUS. Les tendances actuelles dans la conception du calcul des ouvrages en béton armé, Very. *Technique Moderne*, vol. 26, no 10, Aug. 15, 1934, pp. 548–551. Present status in development of calculation of reinforced concrete structures; resistance of materials; characteristics of reinforced concrete; new ideas in calculation; application of analysis to phenomena of adherence; possibilities of photo-elasticity.

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CRUSHED STONE PLANTS, TENNESSEE. T. V A. Plants Designed for Output of 3,000 Cu Yd of Concrete Daily, W. E. Trauffer. *Pit & Quarry*, vol. 27, no. 3, Sept. 1934, pp. 33–42; see also description by C. H. Vivian, in *Rock Products*, vol. 37, no. 9, Aug. 1934, pp. 28–31. Crushed stone plant operated in conjunction with construction of Norris Dam, part of Tennessee Valley Authority undertaking; tabular data on operations and equipment; cement-handling and concrete-mixing plants; aggregate plant and quarry.

DESIGN. Sezioni inflesse di calcestruzzo armato di massima convenienza economica, G. Vignuzzi. *Politecnico*, vol. 82, no. 4, Apr. 1934, pp. 206–219, 1 supp. sheet. Theoretical analysis leading to derivation of formulas and construction of diagrams for computation of most economic dimensions of beams and other structural members made of concrete, including members with double reinforcements.

HARDENING, Temperature of Hardening Concrete, M. S. Stanley. *Instn. Engrs. Australia—Journal*, vol. 6, no. 7, July 1934, pp. 250–251. Original observations on temperature and steel deformations in concrete column, having cross sections of 44 by 44 in., subsequent to pouring.

PROPERTIES. Vom Schwinden und Quellen des Betons, A. Pogany. *Zement*, vol. 23, no. 33, Aug. 16, 1934, pp. 476–480. Shrinkage and swelling of concrete; correlation of results of various investigations according to following aspects: Influence of quality and amount of cement, admixture, mixing water, and temperature on shrinkage; possibility of mathematical treatment of shrinkage stresses; attempt to explain nature of shrinkage stresses in light of new physical research.

REINFORCEMENT, BAMBOO. Concrete Road Construction in China. *Surveyor*, vol. 86, no. 2224, Sept. 7, 1934, p. 222. Use of bamboo as reinforcement in concrete pavements; results of tests of mechanical properties of bamboo. Excerpt from report before Int. Road Congress at Munich.

SLAG. Beton aus granulierter Hochofenschlacke, V. Sevieri. *Tonindustrie-Ztg.*, vol. 58, no. 49, and 50, June 18, 1934, pp. 587–589, and June 21, pp. 601–602. Concrete from granulated blast-furnace slag; blocks prepared with 65 per cent limestone aggregate, 26.25 per cent uncrushed granulated slag and 8.75 per cent slaked lime, which had been used for harbor construction at Portovecchio di Piombino; granulated slag may be used with good results for maritime structures.

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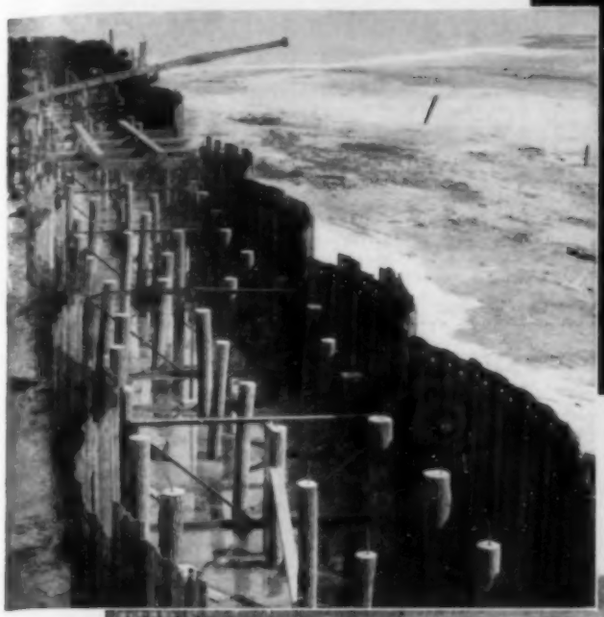
WATERPROOFING, GERMANY. Ueber die Untersuchung von Moerteldichtungsmitteln, C. R. Platzmann. *Zement*, vol. 23, no. 33, Aug. 16, 1934, pp. 471–473. Investigation of waterproofing reagents, showing that stearate content of commercial varieties of such materials is subjected to considerable fluctuations; effect of stearate content; water-impermeability Index was derived indicating utility of mortar admixture.

DAMS

BOULDER DAM PROJECT, HYDRAULIC VALVES. Hydraulic Valves and Gates for Boulder Dam, P. A. Kinzie. *Mech. Eng.*, vol. 56, no. 11, Nov. 1934, pp. 647–662. Design and construction of bulkhead gates.

CONCRETE GRAVITY, CONSTRUCTION. Work Goes On Night and Day at Norris Dam. *Contractors & Engrs. Monthly*, vol. 29, no. 8, Nov. 1934, pp. 19–25. Construction by Tennessee

Contractors Rely on Inland Piling for Mississippi Waterway



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Valley Authority of dam, 1,800 ft long, 210 ft thick at base, 212 ft high; quarry; crushing and screening plant; aggregate storage; sand plant; handling bulk cement; mixing plant; cableways; rate of concreting with towers; forms for dam blocks; labor organization and hours; repair shops and service units.

CONSTRUCTION, MATERIALS HANDLING. Concrete Materials Handling for Norris Dam Construction. *Eng. News-Rec.*, vol. 113, no. 10, Sept. 6, 1934, pp. 301–304. Quarrying, crushing, screen-conveying, and delivery of stone and sand to central mixing plant, on Clinch River in Tennessee, laid out on straight-line production basis; stone and sand delivered to mixing plant by belt-conveyor system; all cement for 1,000,000 cu yd of concrete delivered in bulk by rail from which two portable pumps unload cement to elevated steel silo with capacity of 6,000 bbl.

GEOLOGY. Geology and Civil Engineering, R. F. Legget. *Eng. Journal*, vol. 17, no. 10, Oct. 1934, pp. 431–442. Application of geological principles and methods to practice civil engineering illustrated by examples from actual practice; principal means of contact of science and art; foundation of dams; reservoirs and catchment areas; underground water problems; construction materials; instruction in geology by means of regular civil engineering courses of study at Canadian universities and colleges. Bibliography.

HYDRAULIC FILL. Mechanics of Hydraulic-Fill Dams, G. Gilboy. *Boston Soc. Civ Engrs.—Journal*, vol. 21, no. 3, July 1934, pp. 185–203, (discussion) 204–205. Theories clarifying and rationalizing physical problems involved in hydraulic-fill construction; stability of shell against bursting by internal pressure of core; rate of consolidation of core; seepage of water through core; derivation of stability equation.

SPILLWAYS, MODEL TESTING. Analysis of Boulder Dam Spillways Made by Swiss Laboratory, E. Meyer-Peter and H. Favre. *Eng. News-Rec.*, vol. 113, no. 17, Oct. 25, 1934, pp. 520–522. Results of analytical and experimental model study of side-channel spillways of Boulder Dam, with capacity of 400,000 cu ft per sec, made at Hydraulic Research Laboratory, in Zurich, Switzerland; results of model tests were found to agree very well with results of calculation.

FLOW OF FLUIDS

HYDRODYNAMICS. Elements of Hydrodynamic Analysis, T. R. Loudon. *Eng. Journal*, vol. 17, no. 10, Oct. 1934, pp. 443–450. Condensed mathematical analysis necessary for study of stream-line motion of fluid; stream functions, velocity potential, sources and sinks, and combined stream lines; partial differentiation; exact differentials; complex numbers and variables; functions of complex variable; holomorphic functions; equations of continuity; velocity potential; velocity of flow.

NOTCHES. V-Notch Weir for Hot Water, R. S. Smith, Jr. *Am. Soc. Mech. Engrs.—Trans.*, vol. 56, no. 10, Oct. 1934, pp. 787–789 (RP-56-9). This simple form of weir has wide, accurate range for heads up to 1 ft, is inherently free from aeration difficulties, and has better agreement between data from various sources than would be expected from general experience with other weir forms; details of weirs of V-notch form and their viscosity corrections with hot water. Bibliography.

WEIRS, PARABOLIC. Parabolic Weirs, J. Paton. *Roy. Tech. College—Journal*, vol. 3, pt. 2, Jan. 1934, pp. 268–288. Tests of U-shaped and V-shaped parabolic weirs demonstrating superiority of first type; derivation of practical coefficient for U-shaped weir; critical review of theory of weirs.

FLOOD CONTROL

DISCHARGE. Uusi kaava vesistoen tulvamaaeraen arvioimiseksi sadealueen suuruuden y. m. mukaan, I. A. Hallakorpi. *Teknillinen Aikakauslehti*, no. 10, Oct. 1934, pp. 311–321. Construction of empirical formulas of flood discharge with modifications for conditions obtaining in Finland and other northern European countries, taking into account such factors as water value of snow cover, average melting time of snows, percentage of lake areas on watershed, and permeability of soil.

GREAT BRITAIN. Thames Floods and Catchment Boards, E. S. Bellasis. *Engineer*, vol. 158, no. 4112, Nov. 2, 1934, pp. 442–443. Methods of mitigating floods; improvement works now being carried out on Thames from Weybridge to Teddington.

FOUNDATIONS

DESIGN, FRANCE. Le calcul des fondations des ouvrages en pleine terre, P. Caufourier. *Génie Civil*, vol. 105, no. 16, Oct. 1934, pp. 366–368. Outline and discussion of article by A. S. Klein, on 3-dimensional analysis of design of earth foundations, published in *Constructeur de Ciment Armé* for March and April 1934; 3-dimensional treatment of earth foundation problems lead to great economy in design; application of Mohr's graphical analysis.

DESIGN, UNITED STATES. Application of Theories of Elasticity and Plasticity to Foundation Problems, L. Juergenson. *Boston Soc. Civ. Engrs.—Journal*, vol. 21, no. 3, July 1934, pp. 206–241 and (discussion) 276–283. Outline of method for analyzing stability of foundations against shearing failure by computing maximum shearing stresses in underground and comparing these stresses with shearing strength of material; application of theory of elasticity to foundation problems; determination of shearing strength by cylinder test; squeezing test; comparison of testing methods. Bibliography.

PILES, CONCRETE, TESTING. Load Tests on Concrete Piles for Bonnet Carré Trestle. *Eng. News-Rec.*, vol. 113, no. 20, Nov. 15, 1934, p. 631. Results of tests of piles 20 in. sq, 75 ft long, for 6,000-ft concrete-pile trestle decided upon by Louisiana highway commission for new highway crossing at Bonnet Carré flood spillway.

HYDROLOGY, METEROLOGY, AND SEISMOGRAPHY

EARTHQUAKES. Earthquake Notes and Abstracts of Proceedings of 1934 Meeting. *Seismological Soc. of Am. (Eastern Section)*, vol. 6, nos. 1 and 2, Sept. 1934, 22 pp. Various brief notes and comments; minutes of Ninth annual meeting, Abstracts: Deep-Focus Earthquakes and Allied Problems, V. C. Stechschulte; Communication Regarding Huancayo Seismograph Station, J. A. Fleming; Significance of Barometric Oscillations in Propagation of Microseisms with Special Reference to Ground Unrest During Years 1929–1931; Inclusive, at Sitka, Alaska, D. C. Bradford; Note on Two Microseismic Storms of Past Year, F. W. Sohon; Earthquakes of 1933–1934, J. Lynch; World Distribution of Earthquake Epicenters and Seismic Sea Waves, N. H. Heck; Construction of Azimuthal-Equidistant Projection for Seismograph Station Uses, J. Howells; Modern Earthquake Design of Structures, J. J. Creskoff Research in Engineering Seismology at Massachusetts Institute of Technology, A. C. Ruge Practical Method of Integrating Acceleration Curves, F. Neumann; Earthquakes Instrumentally Recorded in Artesian Wells, R. M. Leggette and G. H. Taylor; Application of Vacuum-Tube Amplification to Indicators and Recorders, R. W. Gilbert; New Seismograph, A. J. Weed; Great Indian Earthquake of January 15, 1934, V. S. Stechschulte; Inverse Boundary Value Problem in Seismology, C. L. Pekeris; Extraordinarily Deep Earthquake of May 26, 1932, G. J. Brunner; Method for Simultaneous Determination of Focal Depth, Epicentral Distance, and Focal Time from Seismograms of Single Station by Means of Graphic Chart, G. J. Brunner; On Location of Deep-Focus Earthquakes, A. Blake; Experiments on Emergence Angle and Propagation Paths, M. Ewing and A. P. Crary; Further Note on Interpretation of Travel-Time Curves, F. Neumann; Precise Determination of Depth of Earth's Core and of P Wave Paths in Mantle, C. G. Dahm; Practical Station Map for Azimuth and Distance with Graphic Rules for Latitude and Longitude, R. J. Buckley.

SEISMOLOGY. Study of Emergence Angle and Propagation Paths of Seismic Waves, M. Ewing and A. P. Crary. *Physics*, vol. 5, no. 10, Oct. 1934, pp. 317–320. Travel-time curves given for elastic waves through earth in region in which velocity increases continuously with depth.

IRRIGATION

AUSTRALIA. River Murray Waters Scheme, H. H. Dare. *Instn. Engrs. Australia—Journal*, vol. 6, no. 6, June 1934, pp. 185–198. Description of provisions of River Murray Agreement and of works, constructed thereunder, together with reference to works proposed under recent amendment of agreement; development under irrigation from Murray River in three states concerned; operation of Hume Dam and Lake Victoria storage. Bibliography.

WATERLOGGING. Gravitational Survey of Sub-Alluvium of Jhelum-Chenab-Ravi Dabs, and Its Application to Problems of Waterlogging, B. H. Wilsdon and N. K. Buse. *Punjab Irrigation Research Inst.—Research Publ.*, vol. 6, no. 1, Feb. 1934, 44 pp. Price 7s 6d. Use of torsion balance for determination of depths of alluvium soils; terrain, extra, cartographical, and normal effects; density determination of rock samples.

WATER SUPPLY TUNNELS, SPECIFICATIONS. Ephraim Tunnel, Ephraim Project, Utah. *U. S. Bur. Reclamation—Specifications*, no. 587 1934, 20 pp. 2 supp. sheets. Schedule, specifications, and drawings for construction of water-diversion tunnel 200 ft long, mostly unlined, of horseshoe section about 5 ft 6 in. high.

LAND RECLAMATION AND DRAINAGE

CULVERTS, WOODEN. Capacity of Creosoted-Wood Culverts Studied, F. T. Mavis. *Eng. News-Rec.*, vol. 113, no. 16, Oct. 18, 1934, pp. 486–487. Tests of laminated, box culvert completed at Iowa Institute of Hydraulic Research, showing that round entrance gives greater capacity than square entrance for given head; roughness factors.

LAND DRAINAGE, GREAT BRITAIN. Notes on Drainage Problems in the Fens, R. G. Clark. *Instn. Mun. & Country Engrs.—Journal*, vol. 61, no. 4, Aug. 14, 1934, pp. 213–218 (discussion) 219–221. Report on marsh land in Middle Level area situated between River Ouse and River Nene, draining area of approximately 179,000 acres; description of equipment, including pumping units.

MATERIALS TESTING

CONCRETE TESTING, STRENGTH. Neues Verfahren fuer die Festigkeitspruefung des Betons im Bauwerk, K. Beljajew. *Zement*, vol. 23, no. 24, June 14, 1934, pp. 340–341. New method for testing strength of concrete in structures, proposed in U.S.S.R.; it is form of ball-indentation test claimed to be cheap and simple.

ELASTICITY. Strain-Gage Location and Value of *E* in Compression, I. F. Morrison and R. M. Hardy. *Eng. News Rec.*, vol. 113, no. 16, Oct. 18, 1934, pp. 502–503. Results of tests at University of Alberta showing that, for compression test, strain-gage points should have contact with test piece not closer to end than diameter of piece.

PORTS AND HARBORS

CALLAO, PERU. Port of Callao, Peru. *Naut. Gaz.*, vol. 124, no. 13, June 23, 1934, pp. 6–12. Particulars of largest natural harbor on the west coast of South America; short historical review; new port development; Peru's railroad system.

CONNEAUT, OHIO. Conneaut Harbor Improved to Accommodate Large Modern Ore Boats, *Eng. News-Rec.*, vol. 113, no. 13, Sept. 27, 1934, pp. 402–404. Extensions and relocations of breakwaters give wider maneuvering space for 600-ft ore carriers; new timber crib sunk for lighthouse base; small rock for jetty handled in LCL containers to site of placement.

KEY WEST, FLA. Key West, Southern Gateway to America. *Naut. Gaz.*, vol. 124, no. 14, July 7, 1934, pp. 5–7. Historical review; port features and characteristics; main advantages of port to all shipping entering and leaving the Gulf of Mexico.

MONTEVIDEO, URUGUAY. Montevideo, Uruguay's Outlet to World Commerce. *Naut. Gaz.*, vol. 124, no. 18, Sept. 1, 1934, pp. 6–10. Port constructed inside natural bay consists of anteport, protein by two cliffs and two basins; basins equipped with large docks and electric cranes with power to lift 5,000 km each; double railroad tracks around docks.

SANTOS, BRAZIL. Brazilian Ports and Commerce—Santos, World's Greatest Coffee Port. *Naut. Gaz.*, vol. 124, no. 17, Aug. 18, 1934, pp. 6–9, and 31. Port is most important exporting center of Brazilian republic; quay 30 ft wide along waterfront; entrance at Forte Barra Grande has width of 800 ft with depth of 50 ft; modern mechanical devices to facilitate loading and discharging of bulk cargoes.

SILT, TRANSPORTATION. Tidal River Silt Movements from Rotterdam to Sea, G. Flaauw. *Eng. News-Rec.*, vol. 113, no. 20, Nov. 15, 1934, pp. 623–625. Movement and settling of silt; formation of silt bars at and in mouths of tidal rivers; suggested means of maintaining ship channels with minimum of dredging; effect of spur dikes in improving channel depth in Rotterdam waterway; submerged dikes suggested to utilize coastal currents in drawing waterways silt out to sea.

ROADS AND STREETS

CONCRETE. New Concrete Paving Methods on Pompton Turnpike. *Eng. News-Rec.*, vol. 113, no. 12, Sept. 20, 1934, pp. 370–372. Methods of pavement construction new in several particulars are being employed on contract for 4½ miles of Pompton Turnpike in New Jersey; use of new equipment models, including dual-drum mixer and gasoline-electric finishing machine; trial of internal vibration, cocoa-curing blankets and devices for installing new type of expansion joint.

CONSTRUCTION PROBLEMS. Schwere Strassenbelaege, R. Neumann. *VDI Zeit*, vol. 78, no. 35, Sept. 1, 1934, pp. 1017–1026. Review of engineering problems and practices in construction of concrete and bituminous roads; design of road cross sections; composition, properties, and tests of concrete and bituminous road surfaces.

CONSTRUCTION, SOIL MECHANICS. Anwendung der Baugrundforschung im Grossstrassenbau, W. Loos. *VDI Zeit*, vol. 78, no. 35, Sept. 1, 1934, pp. 1029–1031. Application of soil mechanics and foundation testing to design and construction of main highways; practical examples.

EXCAVATION, HYDRAULIC. California Washes Highway Through Mountain, G. C. McNutt. *Excavating Engr.*, vol. 28, no. 9, Sept. 1934, pp. 416–417. Hydraulicking through Oregon Hill on highway extending from Redding to Eureka; plan for removal of 6,000,000 cu yd of material, to be washed out of cut 2 miles long, 300 to 400 ft deep; 8-in. and 7-in. nozzles fed through 1,800

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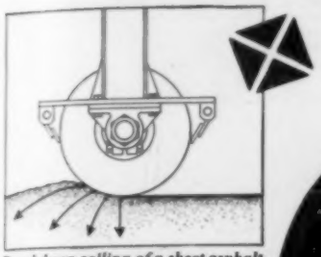
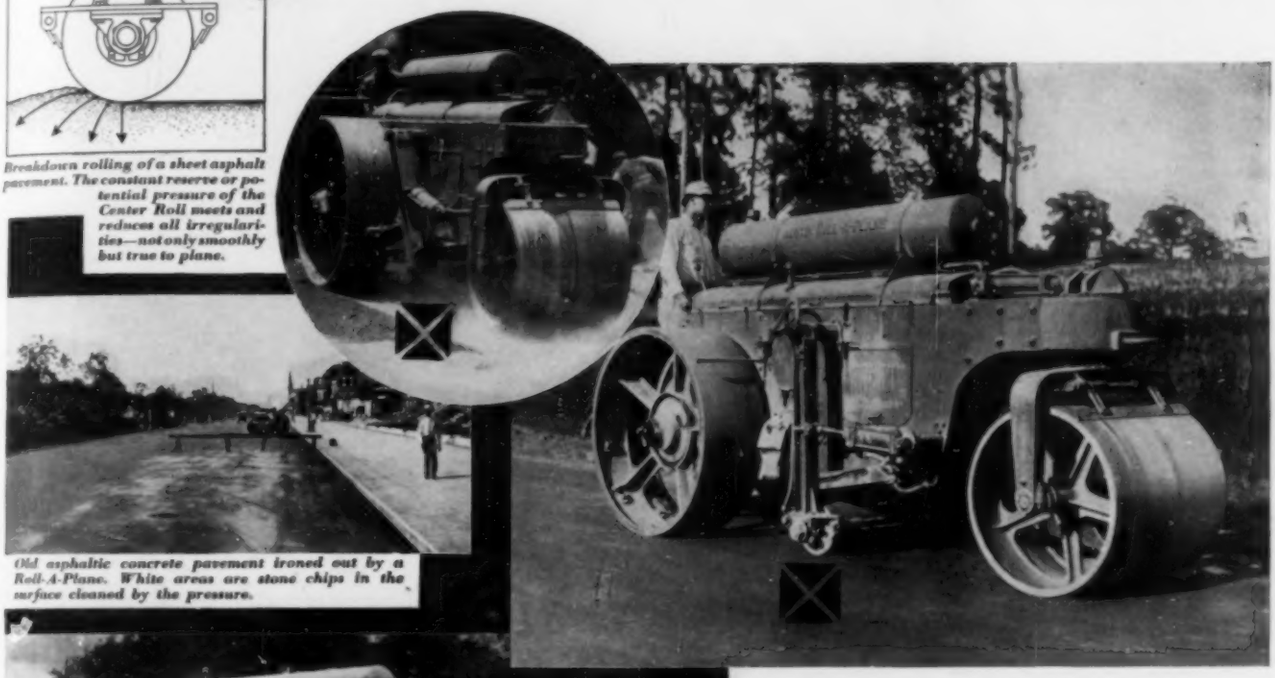
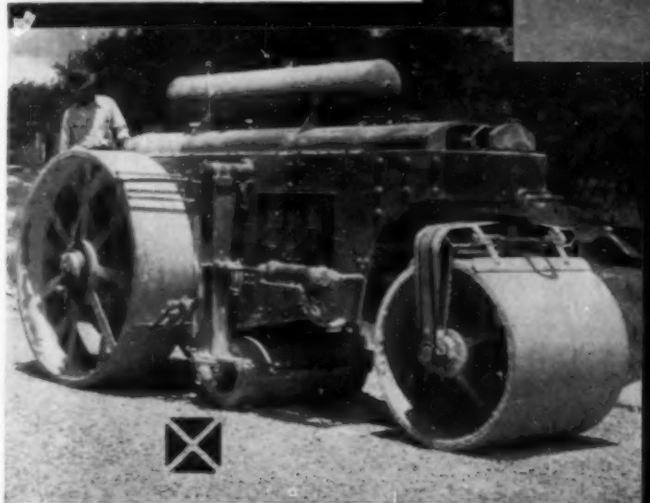


Breakdown rolling of a sheet asphalt pavement. The constant reserve or potential pressure of the Center Roll meets and reduces all irregularities—not only smoothly but true to plane.

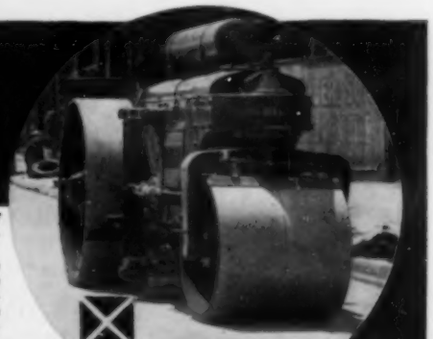


Old asphaltic concrete pavement ironed out by a Roll-A-Plane. White areas are stone chips in the surface cleaned by the pressure.

Entirely new performance from a road roller is demonstrated here in the finish rolling of a road-mix—a true plane surface without cross rolling, the remarkable result of the Center Roll principle.



The Center Roll is shown here on a bituminous macadam job which showed under final test a surface smoothness equal to the usual specifications for pavement of the highest type.



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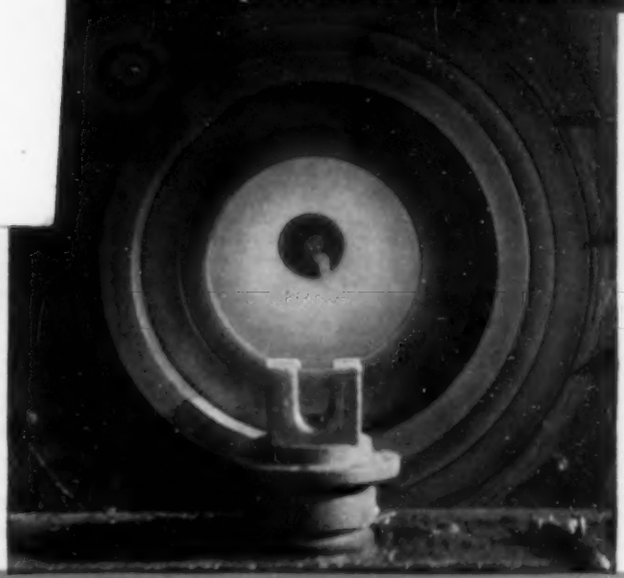

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BERMUDA. Watlington Water Works of Bermuda, W. D. Turner. *Soc. Chem. Industry—Journal (Chem. & Industry)*, vol. 53, no. 40, Oct. 5, 1934, pp. 819–823. Historical; geology of region; early water supply; laying out of project; analysis of water; details of softening plant; chemical treatment; distribution; pipe joints; potability.

LONDON. London's Water Supply. *Surveyor*, vol. 86, no. 2218, July 27, 1934, p. 77. Abstract of annual report of Metropolitan Water Board on sanitary condition of London water supply; safety factor; paratyphoid and typhoid dangers; drought.

WASTE SURVEYS. Making Emergency Water-Waste Survey, F. B. Nelson. *Am. City*, vol. 49, no. 10, Oct. 1934, pp. 45–46. Report on waste survey of New York City waste supply system started in 1931; evident and non-evident leakage and savings; how aquaphone talks; field work; results of three surveys; comparison of successive aquaphone surveys; measuring individual leaks. Before Am. Water Works Assn.

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ENGINEER; Assoc. M. Am. Soc. C.E.; 35; married; North Carolina state license; 15 years experience highway, street, and sewer construction; 9 years as head of public works department in city of 40,000. Desires position with county, city, or contractor. Location preferred in East or South. D-3614.

STRUCTURAL ENGINEER AND ARCHITECT; M. Am. Soc. C.E.; 20 years experience in structural and architectural design, specializing in hotels, apartments, residences; 15 years detailing and designing, steel fabricating shop; quantity surveying, general contracting, general all-round experience, architecture, engineering, and supervision. Desires connection with real estate or contracting company that finances its work, as engineering architect and supervisor. D-3615.

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; graduate civil engineer, Pennsylvania State College; more than 30 years experience on railroad location and construction and appraisal of rural and urban property and land and small buildings. Desires civil engineering position of any nature. D-3619.

CIVIL ENGINEER; M. Am. Soc. C.E.; Graduate of Lehigh University; married; 39; 14 years experience in water-works engineering, concrete construction, hydraulic dredging, valuation, and rate cases. Familiar with design, construction, purification, and distribution of water supplies; 1 year experience with NRA. Preferred location, New York or vicinity. B-7259.

JUNIOR

JUNIOR ENGINEER; Jun. Am. Soc. C.E.; age 23; married; B.S. in C.E.; experience in construction, drafting, surveying. Desires position in any branch of civil engineering. Available on notice. Salary and location secondary. D-2570.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Drexel Institute; 2 years experience in topographic surveying and mapping with state forestry department and municipal water company; 1 year as draftsman on cadastral surveys and mapping with state forestry department. Available immediately; location immaterial—United States or foreign countries. D-3561.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; B.S. in C.E., University of Illinois; age 24; varied experiences, including concrete design for a Middle Western steel company, highway engineering, topographic and railroad surveying, and hydraulics. Good draftsman. Desires position as a civil engineer. Available for work on two weeks notice; location immaterial. D-3595.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; 6 years experience as surveyor, draftsman, inspector on highway, and on sewer, bridge, and building construction; B.S. in C.E., Cooper Union (night class). Speaks German, little Spanish. Desires any type of position that will afford future security. D-3599.

RECENT GRADUATE; Jun. Am. Soc. C.E.; 26; married; B.S. and M.S., Massachusetts Institute of Technology; civil engineering; transportation. Desires part-time employment of any description. Has had some railway and highway experience; also has written reports, done research, tutored, etc. Location, New York City. Salary secondary. D-1987.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; single; B.S. in C.E., Bucknell University, 1932; 2 months experience on construction of electric lines; experienced in uses of transit, levels, and plane table; draftsman. Desires opportunity in any branch of civil engineering. Available immediately. Salary secondary. Location immaterial. D-2924.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; graduate of Ohio Northern University, B.S. in C.E. Has had some experience in general engineering practice, especially surveying, with some topographic and construction work. Salary no object other than to make a living. Available immediately. Location immaterial. D-2177.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; B.S. in C.E., 1930; over 2½ years varied engineering experience, including highway design and construction, design of sewage disposal plant, regional planning, mapping, drafting, surveying, and bridge construction. Desires permanent position in any branch of civil engineering. Willing to work. Location immaterial. Available immediately. C-7666.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; B.S. in C.E., Georgia School of Technology, 1930. Experienced in topographic surveying, industrial plant construction, operation and maintenance, and sales engineering. Desires work in any phase of civil engineering or sales engineering. Single. Location and salary open, provided position promises permanency. D-3345.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 30; married; B.S. in C.E.; M.S. in Eng.; C.E., University of Florida; 3 years experience in design and operation of sewage-treatment plants, water-supply systems, and sanitary engineering. Desires position in sanitary engineering. Available immediately; location immaterial. C-4329.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Duke University, 1933. Majored in design of structural steel and water supply systems; 1 month with U. S. Coast and Geodetic Survey; 3 months experience, water and sewage works; 3 years as inspector of telephone apparatus. Desires opportunity in any branch of civil engineering. Location immaterial. Available immediately. D-2683.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 29; single; B.S. in civil engineering; M.S. in mathematics; 1 year teaching mathematics; 4 years experience in charge of statistical life studies of telephone equipment; familiar with accounting procedure. Desires opportunity in the field of statistical engineering study or survey. Location and salary secondary. D-3624.

SALES

ENGINEER EXECUTIVE; M. Am. Soc. C.E.; registered in Pennsylvania; steel construction industry, also general contracting; supervision of engineering, estimating, operations, and sales. Efficient organizer and producer. Also experienced as district representative. Available immediately. C-5095.

RECENT BOOKS

New books of interest to Civil Engineers, donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 75 of the Year Book for 1934. These notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ANCIENT EGYPTIAN MATERIALS AND INDUSTRIES. By A. Lucas. 2 ed. London, Edward Arnold & Co.; New York, Longmans, Green & Co., 1934. 447 pp., tables, 9 × 5 in., cloth, $6.

A summary of the knowledge that archeological research has yielded about the materials and industries of ancient Egypt, supplemented with information gathered from ancient authors.

A.S.T.M. TENTATIVE STANDARDS, 1934. Philadelphia, American Society for Testing Materials, 1934. 1257 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $8; paper, $7.

The new issue of this valuable work contains 236 specifications, methods of testing, definitions of terms and recommended practices covering materials of engineering, which have been tentatively approved by the society. Proposed revisions of standards are also included in the volume.

GEOLOGY OF PUERTO RICO. (Monographs of the University of Puerto Rico, Series B, No. 1.) By H. A. Meyerhoff. San Juan, University of Puerto Rico, 1933. 306 pp., illus., diagrs., 9 × 6 in., paper, $1.50.

This work gives a concise account of the geology of the island, accompanied by a large-scale geologic map and an excellent bibliography. The author has been a student of the geology of the West Indies for a number of years and writes from extensive personal familiarity with Puerto Rican geology, as well as with the work of other investigators.

INTERNATIONAL ASSOCIATION FOR BRIDGE AND STRUCTURAL ENGINEERING. Paris, May 19–25, 1932, final report. Published by the General Secretariat in Zurich, Switzerland; on sale at Gebrüder Leeman & Co., 1934. 715 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, 36 Swiss francs.

This final report of the congress supplements and completes the Preliminary Publication, which was published in 1932. The present volume contains the contributions to the discussions, the conclusions formulated at the various sessions, the speeches delivered at the opening and closing meetings, a list of participants, etc. The principal subjects considered at the congress were as follows: the stability and strength of structural members subjected to compression and bending; slabs in reinforced concrete structures; welding in structural steel work; large reinforced concrete girder bridges; the dynamics of bridges; the influence of the physical properties of materials upon the statics of reinforced concrete; steel girders in conjunction with concrete; and the bearing capacity of shallow foundations.

LA MANUTENTION MÉCANIQUE. (Collection Armand Colin, Section du Génie civil, No. 156.) By M. Legras. Paris, Librarie Armand Colin, 1934. 220 pp., diagrs., tables, 7 × 5 in., paper, 10.50 rm.

Different types of conveyors, hoists, and transporters are described in this volume and some of the more common problems of materials handling are discussed.

SECHSSTELLIGE TAFEL DER TRIGONOMETRISCHEN FUNKTIONEN. By J. Peters. Berlin and Bonn, Ferdinand Dümmlers Verlag, 1929. 293 pp., tables, 10 × 7 in., paper, 32.40 rm.

These tables are designed for users of calculating machines, who wish something more convenient than the usual seven-place tables. The six functions are given for values between zero and 90 deg in 10-sec intervals. In addition, there is a table giving cotangents and cosecants for 1-sec intervals between zero and 1 deg 20 min. The tables are well printed and are arranged so that the most used functions (sine, tangent, cotangent, and cosine) are in the outside columns, where they are more accessible.

TECHNIQUE OF EXECUTIVE CONTROL. By E. H. Schell. 4 ed. New York and London, McGraw-Hill Book Co., 1934. 231 pp., 8 × 5 in., cloth, $2.

This book discusses the problems of the executive in his relations with his subordinates and superiors, and aims to provide "a guide to executive straight-thinking." Methods for securing effective cooperation are considered in detail.

VERMESSUNGSKUNDE. III. Trigonometrische und barometrische Höhenmessung, Tachymetrie und Topographie. (Sammlung Göschen, 862.) By P. Werkmeister. 3 ed. Berlin and Leipzig, Walter de Gruyter & Co., 1934. 144 pp., diagrs., charts, tables, 6 × 4 in., cloth 1.62 rm.

Methods of trigonometric and barometric leveling, stadia surveying, and topographic work are concisely presented in this little book, which is the third and final volume of a practical text on surveying.

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BRIDGES

CONCRETE ARCH, FRANCE. Observations faites a l'occasion de la construction du pont en béton armé de la Citadelle, a Strasbourg, G. Meo. *Génie Civil*, vol. 105, no. 21, Nov. 24, 1934, pp. 479–481. Design and construction of reinforced-concrete bowstring arch bridge over basin of river port of Strasbourg, France, consisting of three spans, 53 m to 63 m in length, having width of 20 m; results of tests.

FLOORS. Solid Steel Deck for Railroad Bridge. *Eng. News-Rec.*, vol. 113, no. 21, Nov. 22, 1934, pp. 643–646. Reconstruction of Susquehanna River (North Branch) crossing of Reading Railroad between Rupert and Catawissa, Pa., consisting of nine steel, riveted, truss spans of about 157 ft each, on skew of 54 deg, for E-70 loading; first railroad bridge to use interlocking-channel type floor surfaced with asphalt plank; carries conventional ballasted track.

STEEL ARCH, CZECHOSLOVAKIA. Die erste vollstaendig geschweisste Bogenbruecke, F. Faltus. *Elektroschweissung*, vol. 5, no. 7, July 1934, pp. 134–135; see also *Eng.-News Rec.*, vol. 113, no. 19, Nov. 8, 1934, p. 593. Description of longest European all-welded steel-arch bridge, near Pilsen, Czechoslovakia; consists of two 2-hinged arch ribs spaced 20 ft 8 in. apart, having rise of 35 ft; total width of structure is 29½ ft; all welds made continuous; about 6 miles of bare and covered electrodes were consumed; weight of steel structure is 110 tons.

STEEL TRUSS, AFRICA. Long Rail Bridge Completed Over Zambesi River in Africa. *Eng. News-Rec.*, vol. 113, no. 23, Dec. 6, 1934, p. 725. Features of bridge consisting of 2,589 ft of viaduct, 33 main-truss spans 262½ ft long, and six approach spans; aggregate total over-all length is 11,650 ft 9 in.; cost about $7,200,000.

WOODEN, HISTORY. Maine Recreates First Pile Bridge in America, P. D. Orcutt. *Eng. News-Rec.*, vol. 113, no. 20, Nov. 15, 1934, pp. 616–617. Sewall's Bridge at York, built in 1761, replaced by modern timber structure, preserving appearance of original; piles 172 years old found in fair state of preservation.

BUILDINGS

AIR CONDITIONING. Conditioned Air in La Maison Française, A. Merle. *Elec. Journal*, vol. 31, no. 8, Aug. 1934, pp. 301–304 and 334. Air conditioning, in most complete sense, is effected in building of Rockefeller Center; control of dust, odors, sound, vibration, ion content, and evenness of distribution; notes on equipment; illustrations; operating characteristics.

MOVING PICTURE THEATERS. Consulting Engineer Surveys Theater Heating and Air Conditioning—Finds Need for Modernization, D. D. Kimball. *Heating, Piping & Air Conditioning*, vol. 6, no. 12, Dec. 1934, pp. 497–500. Survey of heating, ventilation, and air conditioning of 76 motion picture theaters; results showed many situations needing correction and numerous opportunities for necessary modernization.

RADIO CENTER. Air Conditioning in Rockefeller Center Development, A. W. Canney. *Ice & Refrig.*, vol. 87, no. 5, Nov. 1934, pp. 205–215. Illustrated description of systems installed in buildings of this group in New York City; previous practice in air conditioning; planning installation for individual needs; description of Music Hall and Center Theater systems.

CITY AND REGIONAL PLANNING

ENGINEERING HANDBOOKS. Huette des Ingenieurs Taschenbuch. 26 ed. Bd. 3, Lieferung 2 ed. by Akademischer Verein Huette. Berlin, Wilhelm Ernst & Sohn, 1934, pp. 677–1204, diagrs., charts, tables, 7 rm. Publication completes third volume of this well-known handbook and includes sections devoted to road building and regional planning, bridge building, and railroads, together with 15 appendixes of standards, specifications, and tables and index to whole volume.

CONCRETE

AGGREGATE SLAG. Das Verhalten der Sulfide der Hochofenschlacke in Zementmoertel und Beton, H. Burchartz and E. Deiss. *Archiv. fuer das Eisenhuettenwesen*, vol. 8, no. 5, Nov. 1934, pp. 181–186. Behavior of sulfides of blast-furnace slags in cement mortars and concrete. It is claimed slags as aggregate do not cause water in mixture to absorb undue amount of sulfides; very negligible oxidation of sulfides occurs; hence, there can be no reasonable objection to unlimited use of slag as aggregate for mortar and concrete in hydraulic structures.

CONSTRUCTION. Les constructions acier-béton système "Alpha," M. Ros. *Ossature Metallique*, vol. 3, no. 4, Apr. 1934, pp. 195–208. Patented system of reinforced-concrete construction making use of welding and of spiral or undulated longitudinal reinforcement, finding application in construction of bridges, slabs, etc.; results of tests of concrete slabs reinforced in accordance with this system.

Norris Dam Concrete Plant. *Eng. News-Rec.*, vol. 113, no. 23, Dec. 6, 1934, pp. 726–729. Description of concrete plant designed for delivery of about 1,000,000 cu yd of concrete for construction of Tennessee Valley Authority's Norris Dam on Clinch River; mix can be changed instantly to any one of five combinations of aggregate proportions; three 3-yd mixers rated at 180 cu yd per hr; plant requires small crew of workmen.

FLOORS. Here's a Cure for Floors Like This, E. Perry. *Factory Mgmt. & Maintenance*, vol. 92, no. 10, Oct. 1934, p. 469. Illustration of badly worn concrete floor with description of hardening processes and special treatments to produce greater endurance.

WATERPROOFING, FRANCE. Valeur des hydrofuges pour l'imperméabilisation des bétons, E. Marcotte. *Génie Civil*, vol. 105, no. 14, Oct. 6, 1934, pp. 309–312. Review of experimental studies made by U. S. Bureau of Standards on use of calcium chloride, soaps, bentonite, and other materials for waterproofing of concrete; results of similar work by Laboratoire des Ponts et Chaussees; effect of admixtures on strength of concrete; use of bituminous coatings on concrete.

CONSTRUCTION INDUSTRY

ACCIDENT PREVENTION. Safety in Building Construction, J. Russell, Jr. *Safety Eng.*, vol. 68, no. 5, Nov. 1934, pp. 197–198. Details that engineer should examine most thoroughly from standpoint of safety; for any type of construction, study of accident records on other similar types of project is recommended. Before Civil Eng. Students at Case School of Applied Science.

CAMPS. Highway, Street, Alley, and Parking Area Surfacing; Sidewalks; Curbs and Gutters; Catch-Basins; and Storm Sewers for Government Camp at Grand Coulee Dam, Columbia Basin Project, Washington. *U. S. Bur. Reclamation—Specifications*, no. 581, 1934, 31 pp., 6 supp. sheets. Schedule, specifications, and drawings.

DAMS

BOULDER DAM PROJECT, HYDRAULIC VALVES. Hydraulic Valves and Gates for Boulder Dam—V, P. A. Kinzie. *Mech. Eng.*, vol. 56, no. 12, Dec. 1934, pp. 741–749. Erection of bulkhead gates and their hoisting mechanism.

CONCRETE GRAVITY, OREGON. Bonneville Dam on Columbia. *Eng. News-Rec.*, vol. 113, no. 18, Nov. 1, 1934, pp. 547–552. Combined power development and navigation improvement project on Columbia River, 40 miles above Portland, Ore., involving construction of concrete gravity overflow dam, 170 ft in maximum height, 1,250 ft long, with filling capacity of 1,600,000 cu ft per sec; power plant will consist of 10 units with total ultimate capacity of 430,000 kw; ship lock will be 76 ft wide, 500 ft long; 27-ft depth on sill at ordinary low water.

DESIGN, MODELS. Dam Stresses and Strains Studied by Sluice Models, J. L. Savage. *Eng. News-Rec.*, vol. 113, no. 23, Dec. 6, 1934, pp. 720–723. Tests of maximum cantilever sections of Boulder, Norris, and Grand Coulee dams made in U. S. Bureau of Reclamation's laboratory at Colorado University, indicate that plaster-celite models are useful in determining load deflections, stress conditions at corners, galleries, etc.; such tests may give misleading stress curves in foundation material due to necessity of using rigid boundary conditions for models.

RESERVOIR, OUTLETS. New Water Screening System at Chichester Dam, J. M. C. Corlette. *Instn. Engrs. Australia—Journal*, vol. 6, no. 8, Aug. 1934, pp. 287–289. Description of new screening equipment consisting of enclosed cylindrical screens, operating under pressure of about 43 lb per sq in., installed as two units, one of which is normally in operation; method of cleaning screens by backwashing.

RESERVOIRS, SANITATION. Gesundheitliche Massnahmen bei der Saidenbachtalsperre der Stadt Chemnitz, A. F. Meyer. *Gesundheits-Ingenieur*, vol. 57, no. 15, Apr. 14, 1934, pp. 190–196. Watershed protection by forestation and other sanitary measures, including sedimentation of flood waters, aeration of water, and stripping of reservoir at Saidenbach, for water supply of city of Chemnitz, Germany.

FLOOD CONTROL

HYDRAULICS. Hydraulics of Flood Movements in Rivers, H. A. Thomas. *Carnegie Inst. Tech.—Bul.*, 1934, 70 pp. Review of laws governing steady flow in open channels; uniformly progressive flow; dynamic propagation of stable wave forms; laws of unsteady flow in channels; use of hydraulic models for solving problems in unsteady flow; approximate methods for routing flood waves in uniform channel; routing flood waves in actual rivers.

OHIO. Construction Starts Soon on Muskingum Flood-Control Dams, T. T. Knappen. *Eng. News-Rec.*, vol. 113, no. 18, Nov. 1, 1934, pp. 563–565. Outline of flood control project for tributary of Ohio River, involving construction of 15 dams with total cost of $35,290,000; distribution of flood control on various rivers in Muskingum Valley; characteristics of official plan of reservoirs; Muskingum watershed.

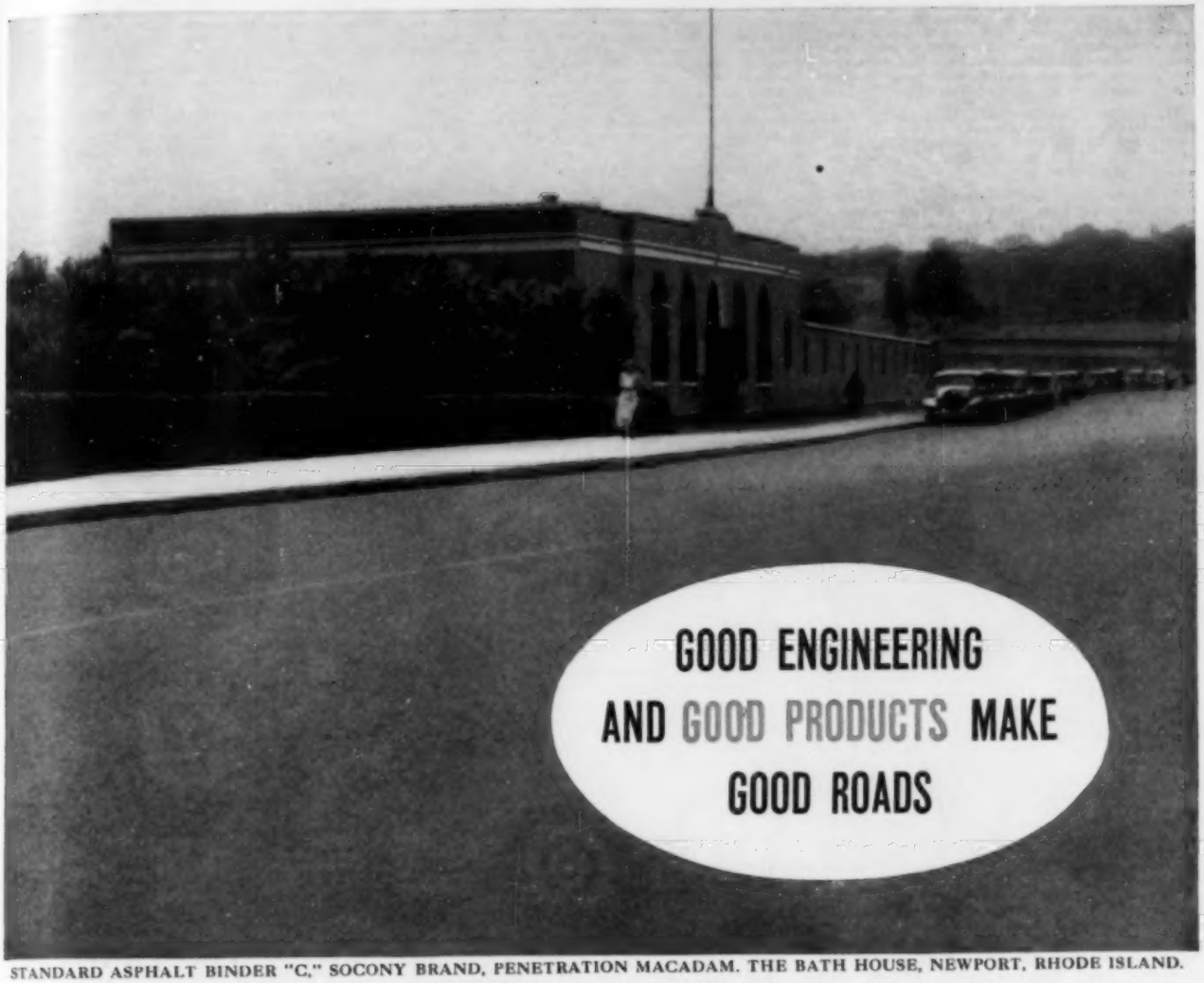
RIVERS, IMPROVEMENT. Regelungsarbeiten am Missouri, L. G. Straub. *VDI Zeit*, vol. 78, no. 39, Sept. 29, 1934, pp. 1144–1145. Regulation of Missouri River; description of recent improvements, such as dykes, revetments, etc.

FOUNDATIONS

CAISSON DISEASE. Preventing Illness in Compressed Air Work, T. Oliver. *Nat. Safety News*, vol. 30, no. 3, pt. 1, Sept. 1934, pp. 34 and 36. Features of caisson construction and use; air-lock procedure in movement of workmen; averting unpleasant symptoms; theories advanced to explain compressed air illness. Before Int. Congress on Life Saving.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

EARTHQUAKES. Wave Propagation Parallel to Plane Surface of Elastic Solid, with Seismological Applications, S. Higuchi. *Tohoku Imperial Univ.—Tech. Reports*, vol. 11, no. 3, 1934, pp. 278–286, 2 supp. plates. Using simple calcula-



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tions, author has solved problem of propagation of elastic wave parallel to plane surface of semi-infinite solid; it seems that wave deduced gives important suggestions with respect to classification of phases of earthquake wave, especially when recorded at station situated rather near source. (In English.)

HYDROLOGY. Section of Hydrology. *Nat. Research Council (Am. Geophys. Union—Trans.)* mtgs., Apr. 26–28, 1934, and June 20–21, 1934, pt. II, June 1934, pp. 263–633. 67 papers on a variety of subjects.

METEOROLOGY. General Assembly. *Nat. Research Council (Am. Geophys. Union—Trans.)* mtgs., Apr. 26–28, 1934, and June 20–21, 1934, pt. I, June 1934, pp. 5–32. Progress in Development of United States Weather Service in Line with Recommendations of Science Advisory Board, W. R. Gregg; Use of Aerological Observations in Weather-Forecasting, H. C. Willett; Complete Weather-Maps of Northern Hemisphere in Relation to Studies of Movements of Major Air-Masses, C. L. Mitchell; Preliminary Report on Upper-Air Work Undertaken in Canada During Second International Polar Year (Abstract) J. Patterson; Upper-Air Winds Over Northern Alaska During Polar Year, August 1932 to August 1933, L. A. Stevens; Mount Washington's Contribution to Second International Polar Year, S. Pagliuca; Apparatus to Be Carried on National Geographic Society, Army Air Corps Stratosphere Flights (Abstract), A. W. Stevens; Short Report on Fifth General Assembly of International Union of Geodesy and Geophysics, Lisbon, Portugal, September 1933, J. A. Fleming, H. D. Harradon, and W. D. Lambert.

Section of Meteorology. *Nat. Research Council (Am. Geophys. Union—Trans.)* mtgs., Apr. 26–28, 1934, and June 20–21, 1934, pt. I, June 1934, pp. 95–135. Background for Fire-Weather Warnings, E. B. Calvert; Reorganization of Ocean Weather-Records for New Applications, W. F. McDonald; Climatological Work Accomplished Through Cooperation with United States Civil Works Administration, J. B. Kincer; Purpose of Compilations of Aerological Data Being Made Under Civil Works Administration Program of Weather Bureau, L. P. Harrison; Adjustment and Standardization of Weather Bureau's River-Gage System with Public Works Fund, M. W. Hayes; Report on Sounding-Balloon Work Carried Out in United States During Polar Year, J. C. Ballard; Some Aspects of Surface of Subsidence, J. Namias; Aerological Studies on Mount Washington, S. P. Ferguson; Differences Between Temperatures, Humidities, and Winds on White Mountains and in Free Air, I. I. Schell; History of Mountain Meteorology in United States and Mount Washington Observatory, R. G. Stone; Atmospheric Ionization near Ground During Thunder-Storms, G. R. Wait and A. G. McNish; Lightning-Discharges to Grounded Conductors; J. C. Jensen.

RAIN AND RAINFALL, OHIO. Hydrological Data from Miami Conservancy District, C. S. Bennett. *Eng. News-Rec.*, vol. 113, no. 18, Nov. 1, 1934, pp. 556–558. Rainfall and run-off data on catchment area above Dayton, Ohio; annual and seasonal run-off; storm rainfall-run-off ratio; rainfall at adjacent stations; river channel "n"; channel improvement of Miami River at Hamilton.

RESERVOIRS, SARDINIA. Le possibilita per la creazione di serbatoi artificiali in Sardegna in rapporto alle caratteristiche fisiche dell'isola, A. Rampazzi. *Annali dei Lavori Pubblici*, vol. 72, no. 5, May 1934, pp. 384–397. Review of hydrology of island of Sardinia, with special reference to possibilities of water storage; list of 46 existing and projected water storage reservoirs with dams up to 63 m in height.

SEISMOLOGY. Section of Seismology. *Nat. Research Council (Am. Geophys. Union—Trans.)* mtgs., Apr. 26–28, 1934, and June 20–21, 1934, pt. I, June 1934, pp. 57–94. Seismological Progress-Report, N. H. Heck; Report of Jesuit Seismological Association for 1933, J. B. Macelwane; Installations of Tiltmeters, G. E. Merritt; First-Order Leveling as Aid in Seismological Investigations in United States, H. S. Rappleye; Earthquake of September 6, 1933, and Its Bearing on Problem of Deep Earthquake, G. J. Brunner; Formula for Weathering Correction, H. M. Rutherford; New Values for Dilational Wave-Velocities Through Earth, C. G. Dahm; Bay of Acapulco and Its Relation to Earthquakes in Southern Part of Mexican Republic, P. C. Sanchez; Seismological Observations on Quarry-Blasting, M. Ewing, A. P. Crary, and J. M. Lohse.

INLAND WATERWAYS

UNITED STATES, MILL GOULEE CANAL. Earthwork and Structures, Mill Goulee Canal, Station 326 to Station 564, and Laterals and Sublaterals, Greenfields Division, Sun River Project, Montana. *U. S. Bur Reclamation—Specifications*, no. 596, 1934, 34 pp., 30 supp. sheets. Schedules, specifications, and drawings for construction of some 24,000 ft of main canal, varying in bottom width from 10 to 16 ft and in total depth from 4 to 5.5 ft.

UNITED STATES, NORTH CANAL. Earthwork and Structures, North Canal, Station 2283 to Station 3703, Dead Ox Flat Division, Owyhee Project Oregon-Idaho. *U. S. Bur. Reclamation—Specifications*, no. 600, 1934, 39 pp., 44 supp. sheets. Schedules, specifications, and drawings for construction of main canal about 42,000 ft long, having bottom width of from 6 to 14 ft and depth of from 5 to 8 ft, including minor siphons and other appurtenant structures.

MATERIALS TESTING

CEMENT TESTING. Effect of Cement Composition on Mortars and Concretes, H. F. Gonnerman. *Eng. News-Rec.*, vol. 113, no. 21, Nov. 22, 1934, pp. 651–656. Properties of mixtures made from cements of 72 different compound compositions reported for one, two, and three-year periods; cement manufacture; cement composition in relation to strength, length changes, and resistance to sulfate solutions; freezing and thawing; tests of MgO cements.

STRENGTH OF MATERIALS. Fragen der angewandten Mathematik und Mechanik. *VDI Zeit.*, vol. 78, no. 45, Nov. 10, 1934, p. 1323. Brief abstracts of papers by L. Foeppl, H. Neuber, H. Ebner, H. Fromm, K. Ludwig, and R. Hoeger on photo-elastic measurements, stresses in structural members, elastic deformation, vibrations, etc., presented before German Society of Physicists and Mathematicians.

PORTS AND MARITIME STRUCTURES

BALTIMORE. Port of Baltimore, G. H. Pouder. *Naut. Gaz.*, vol. 124, no. 24, Nov. 24, 1934, pp. 1–2 and 31. Port characteristics, improvements, features, and activities.

SEAWALLS, SEATTLE DESIGN. Seawall of Novel Design for Seattle Waterfront. *Eng. News-Rec.*, vol. 113, no. 19, Nov. 8, 1934, pp. 579–583. Seawall, 6,100 ft long, having facing of pre-cast concrete slabs with sheet-piling cut-off beneath; heavy thrust transmitted to timber caps; railroad tracks supported on fill over relieving platform.

SEAWALLS, SEATTLE, TESTS. Pre-cast Slabs of Dense Concrete for Harbor Seawall. *Eng. News-Rec.*, vol. 113, no. 19, Nov. 8, 1934, pp. 583–584. Tests of concrete for Seattle waterfront improvement, showing strength as high as 7,800 lb per sq in.; slabs, cast face downward and vibrated thoroughly, are 18 in. thick, and each has 12 by 20-ft face exposed to sea water.

PUBLIC WORKS ENGINEERING

PUBLIC WORKS, UNITED STATES. Undertakings Without Precedent. *Eng. News-Rec.*, vol. 113, no. 22, Nov. 29, 1934, pp. 675–707. Symposium on extraordinary undertakings of Federal Government, including, Power, Navigation, and Irrigation in Two Projects on the Columbia; Boulder Canyon Project; Parker Dam Being Built for Metropolitan Water District; Fort Peck Dam—$84,200,000 Aid to Navigation on Missouri River; Irrigation and Power on North Platte River; TVA Experiment in Regional Development.

ROADS AND STREETS

BITUMINOUS. Toward Better Bituminous Roads, J. S. Crandell. *Eng. News-Rec.*, vol. 113, no. 21, Nov. 22, 1934, pp. 658–661. Survey of tar and asphalt road building; improvement most demanded in bituminous-road practice; differences in design practice; specification practice; increased use of emulsions and cutbacks; priming bases and subgrades; surface treatment of earth roads; progress in mechanical mixers and spreaders; improvement in non-skid properties.

BITUMINOUS, GERMANY. Ueberblick ueber den deutschen Teerstrassenbau 1934, H. Laeger. *Brennstoff-Chemie*, vol. 15, no. 17, Sept. 1, 1934, pp. 323–326. Outline of development of German tar-road construction in 1934; materials used in manufacture of tar concrete; surface tarring; tar penetration macadam.

BITUMINOUS, GREAT BRITAIN. Some Aspects of Construction and Maintenance of Roads with Tar in Great Britain, W. E. Cone. *Surveyor*, vol. 86, no. 224, Sept. 7, 1934, pp. 221–222. Review of practice in tar treatment of roads; surface dressing; gritting; tar macadam; foundations and laying; tar concrete. Before Int. Road Tar Conference, Munich.

BITUMINOUS, UNITED STATES. Study of Methods of Building Low-Cost Bituminous Roads—II, J. T. Pauls. *Am. City*, vol. 49, no. 10, Oct. 1934, pp. 65–66. Bituminous dust treatments; bituminous soil treatments; tests of liquid asphaltic materials. Before Univ. Mich. Highway Conference.

BRICK, PAVING. Vom Verblender zum Strassenklinker. *Tonindustrie-Ztg.* vol. 58, no. 39, May 14, 1934, pp. 475–478. From facing brick to vitrified brick in road construction; recollections and experiences of writer over long period.

CAST IRON. Cast-Iron Block Pavement for Test Road in Minnesota. *Eng. News-Rec.*, vol. 113, no. 19, Nov. 8, 1934, p. 599. Experimental pavement, 30 ft by 24 ft, laid by University of Minnesota, of triangular cast-iron blocks with diamond-shaped studs on upper surface and cored out and ribbed on under side; blocks were laid on concrete base on ¼-in. bed of hot asphalt.

CONCRETE. Comments on Concrete Road Design. *Eng. News-Rec.*, vol. 113, no. 20, Nov. 15, 1934, pp. 618–619. Past and prevailing practices in concrete-road design and construction considered in light of theory and experience by P. M. Tebbs, assistant chief engineer, Pennsylvania Department of Highways, Harrisburg, Pa.; progress in rationalizing slab design; design factors; improvement in concreting practice; new curing methods; results being secured in pavement smoothness; control of construction; final requirement for well-built road.

Some Aspects of Portland Cement Concrete Pavement Construction, W. A. Bianchette. *Pub. Roads*, vol. 15, no. 5, July 1934, pp. 109–131. Review of great progress and increase in efficiency of construction of concrete roads in United States, leading to following conclusions: no consistent relation found between number of men employed and efficiency of operation; efficiency of paver operation is generally indication of efficiency of entire organization; preventable delays; causes of inefficiency; unit costs per square yard; equipment.

CONSTRUCTION. Rectifying Old Main Road Out of Pittsburgh, Pa. *Eng. News-Rec.*, vol. 113, no. 23, Dec. 6, 1934; pp. 715–719. Rectification of trunk highway, involving extensive relocation and longest continuous stretch of 3-lane concrete pavement in Pennsylvania; from city limits of Pittsburgh, north 27 miles to Butler, Pa.; handling of mechanized materials.

CONSTRUCTION, FILLS. Settling Fills in Pacific Northwest, A. J. McAdams. *Contractors & Engrs. Monthly*, vol. 29, no. 4, Oct. 1934, pp. 25–26. Effect of settling of road earth fills by improved blasting methods as exemplified by recent road construction through marsh lands in state of Washington. From *Du Pont Magazine*.

CONSTRUCTION, RELOCATION. Relocating Road to Concord from Charles River. *Eng. News-Rec.*, vol. 113, no. 19, Nov. 8, 1934, pp. 590–593. Description of 15.2-mile relocation from Cambridge to point beyond Concord, Mass., with six traffic lanes at its Cambridge end, carrying through with four lanes of modern high-type pavement; details of bituminous macadam and concrete road sections.

DESIGN. Considerazioni economiche sui muri di sottoscarpa dei terrapieni stradali, L. La Magna. *Politecnico*, vol. 82, no. 6, June 1934, pp. 330–336. Economics of use of retaining walls to support road embankment on ground sloping transversely with reference to road axis; theoretical deductions as to proper location and dimensions of such retaining walls.

EARTH. La Construccion de Caminos de Tierra en Neustra Region Pampeana, J. C. Bustos. *Caminos*, vol. 1, no. 2, Apr. 1934, pp. 30–42. Construction of earth roads in pampas region of Argentina; climate and topography; soil characteristics; standards for construction and maintenance; special tests, as for capillarity, compaction, and permeability; economic considerations.

EMULSIONS. Studi sulle emulsioni bituminose M. G. Levi. *Annali dei Lavori Pubblici*, vol. 72, no. 5, May, 1934, pp. 419–438. Review of Italian and other European and American tests of bituminous emulsions, including examinations of homogeneity, grade of dispersion, viscosity, sedimentation, and stability under various conditions.

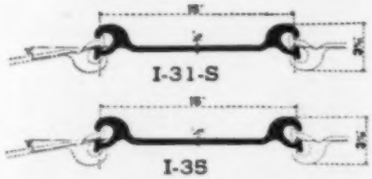
HIGHWAY ENGINEERING, INTERNATIONAL CONGRESS. Le VII^{e} Congres International de la Route (Munich, 31–8 septembre 1934), J. Thomas. *Génie Civil*, vol. 105, no. 14, Oct. 6, 1934, pp. 312–314 and 336–338. Continuation of report of proceedings of Seventh International Highway Congress; abstracts of papers and discussions on legislation, administration, and use of signal systems for accident prevention in highway and street traffic; discussion of resolutions pertaining to effect of road surface on economy of highway transportation; review of rules concerning vehicular loads and dimensions; notes on highway exposition held at Munich.

HIGHWAY ENGINEERING, UNITED STATES. El Trazado y Explotacion de Carreteras Relacionados Con la Coordinacion de Transportes, C. G. Gerstrom. *Caminos*, vol. 1, no. 2, Apr. 1934, pp. 42–54. Development and operation of highways, in relation to coordination of transportation; statistics of automotive and railway passenger traffic in United States; motor-truck and railway ton-mile comparisons; advantages of motor transportation; necessity for road building; highway location and design. Bibliography.

Many Use INLAND STEEL SHEET PILING As River and Harbor Development Speeds Dock Construction

Above: 350-foot dock under construction, Omaha Packing Co., Chicago River, Chicago, Ill.; 175 tons Inland Section I-27 used. *At right:* 800-foot dock, Wadhams Oil Co., East Chicago, Ind.; 600 tons Inland Section I-32 used.

New Sections



With the addition of the sections shown above Inland produces a complete line of sheet piling. Properties of the new sections:

	I-31-S	I-35
Wt. per foot	38.8 lbs.	43.8 lbs.
Wt. per square foot of wall	31.0 lbs.	35.0 lbs.
Section Modulus	3.7 in.^{3}	3.8 in.^{3}
Section Modulus per lin. ft. of wall	3.0 in.^{3}	3.1 in.^{3}
Min. Strength of interlock per lineal inch in direct tension	12,000 lbs.	12,000 lbs.

THE great Public Works program progresses—rivers are deepened, widened, placed under control—harbors are dredged, protected—and thus new avenues of transportation are made available for American industry.

Cities, states, other public agencies—industries of all description—are preparing themselves to take advantage of these new facilities. A dock building program of vast proportions is under way.

Foresighted builders are using Inland Steel Sheet Piling for these docks—assuring strength, permanence, shore protection, and an attractive installation as well.

Inland produces all of the nine standard sections of steel sheet piling. Our experienced engineers are at your service. Consult them regarding your dock building problems. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Illinois.

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INLAND STEEL

Sheets Strip Tin Plate Plates Structurals Piling Rails Track Accessories Bars Rivets Billets

HIGHWAY SYSTEMS, EUROPE. La construction d'autoroutes en Italie, en Allemagne et en France. J. Thomas. *Génie Civil*, vol. 105, no. 17, Oct. 27, 1934, pp. 388–392. Construction of automobile highways in Italy, Germany, and France; economic and social significance of highway construction.

HIGHWAY SYSTEMS, GREAT BRITAIN. British Road Developments of Past Fifteen Years. C. H. Bressey. *Instn. Mun. & County Engrs.—Journal*, vol. 61, no. 4, Aug. 14, 1934, pp. 233–240. Non-technical review of progress with special reference to finances.

ITALY. I lavori per la camionaie Genova Serravalle. L. Vandone. *Strade*, vol. 16, no. 1, Jan. 1934, pp. 5–18. Design and construction of concrete highway, 50 km long, 9 m wide, leading from Genoa to Serravalle, including 11 concrete-lined tunnels up to 892 m in length and several large multiple-arch viaducts with arch spans up to 25.5 m in length, rising as high as 46 m above bottom of valley.

LOG FILLS. Redwood Logs Used for Fills on California Highway. *Eng. News-Rec.*, vol. 113, no. 16, Oct. 18, 1934, pp. 500–501. Use of corded logs for fills and construction of new section of Redwood highway through heavily forested areas in northern California, showing saving in cost with attendant advantages in preserving scenic beauty; typical cross section of roadway over log fill.

LOW COSTS. Sealcoat-Type Road Surfaces in Los Angeles County. W. W. Shelby. *Eng. News-Rec.*, vol. 113, no. 17, Oct. 25, 1934, pp. 528–532. Secondary roads of thin light-oil-and-rock wearing surfaces; smoothness and cost of three types compared; patching methods and equipment; new type of cold or hot asphalt distributor.

MACHINERY, SHOVELS. Power-Shovel Operation in Highway Grading. T. W. Allen and A. P. Anderson. *Pub. Roads*, vol. 15, no. 6, Aug. 1934, pp. 147–61. Efficiency study of shovel operation; analysis of time-study data; best position for shovel; angle of swing greatly affects rate of production; dumping dipper load; use of shovel for fine grading generally unprofitable; major time losses analyzed; care of equipment.

MAINTENANCE AND REPAIR. Roads—Surface Dressings. H. R. Hepworth. *Instn. Mun. & County Engrs.—Journal*, vol. 61, no. 3, July 31, 1934, pp. 137–143 (discussion) 143–151. Purpose of surface dressings; improvement in materials and methods; binders; application of binder to road; emulsions; chippings. Before Instn. Mun. & County Engrs.

MATERIALS, BITUMINOUS. Asphalt, Bitumen, and Tar: Their Respective Uses in Road Construction. D. M. Wilson. *Soc. Chem. Industry—J. (Chem. & Industry)*, vol. 53, no. 44, Nov. 2, 1934, pp. 924–929. Definitions; occurrence and properties; uses in road construction; analysis of road materials.

OILING. Study of Oil-Treated Roads in Colorado and Wyoming. C. A. Carpenter. *Pub. Roads*, vol. 15, no. 6, Aug. 1934, pp. 137–146. Results of inspection and study of 150 miles of oil-processed roads in northern Colorado and southeastern Wyoming for purpose of relating characteristics of mix to performance in service; liquid content, type of filler, and drainage conditions appear to affect service quality; correlation of field and laboratory test data; fillers having high volume change are undesirable.

RAILROAD CROSSINGS, ELIMINATION, MILWAUKEE. Extensive Grade Separation Project Has Many Points of Interest. *Ry. Age*, vol. 97, no. 11, Sept. 15, 1934, pp. 305–309. Details of 4¾-million dollar project, being carried out at Milwaukee, Wis., involving depression of 2.45 miles of track, elevation of 2.55 miles, and construction of 13 grade-separation structures at intersections with city streets; extensive use of slope easements from owners of adjacent property as means of avoiding construction of high retaining walls.

RAILROAD CROSSINGS, UNDERPASS. "Boat-Like" Construction Solves Water Problem in Underpass. *Ry. Age*, vol. 97, no. 21, Nov. 24, 1934, pp. 633–637. How the Erie Railroad was forced into unusual procedure and to considerable difficulty in separating grades at crossing in Endicott, N.Y., where it was not feasible to raise its tracks.

SURFACE TREATMENT. Road Surface Dressing. A. C. Hughes. *Surveyor*, vol. 86, no. 2221, Aug. 17, 1934, pp. 163–164. Hampshire experiment and cost data on holding qualities of granite chippings and gravel; surface dressing with cold emulsified bitumen.

UNDEVELOPED COUNTRY. Road Construction In Undeveloped Countries. *Engineering*, vol. 138, no. 3589, Oct. 26, 1934, pp. 454–456. Problems involved; development of special machinery; road-mix construction; description of work done in New York State; photographs showing various operations in connection with road-mix process.

SEWERAGE AND SEWAGE DISPOSAL

MINNEAPOLIS-ST. PAUL. Chemical Precipitation Advised for Twin Cities' Sewage. *Eng. News-Rec.*, vol. 113, no. 19, Nov. 8, 1934, p. 601. Engineering board reports that plain sedimentation, aided during summer months by chemical precipitation, will effect sufficient purification to meet requirements of state board of health; cost estimates of three methods of treating Minneapolis-St. Paul sewage to produce 70 per cent bio-chemical oxygen demand reduction in 90 per cent of time.

PLANTS, COSTS. Bau- und Betriebskosten von Klaeranlagen. H. Rohde. *Gesundheits-Ingenieur*, vol. 57, no. 8, Feb. 24, 1934, pp. 90–93. Statistical data on construction and operating costs of more than 40 German sewage disposal plants built between 1906 and 1932.

PLANTS, SOVIET UNION. Sewer System of City of Moscow. Y. V. Zvyaghinsky. Moscow, Mosreklamizdat. 2d revised edition. 1929, 75 pp., figs, diagrs., charts, tables, maps. History of sewers and sewage disposal plant; public comfort stations; description of main sewage pumping plant, broad irrigation, and aeration station; composition of sewage; financial data; prospects of further development; incinerating plant. Bibliography. (In Russian.)

STRUCTURAL ENGINEERING

BUILDINGS, DESIGN. Earthquake and Wind Design: Suggested Rationalization. J. J. Creskoff. *Eng. News-Rec.*, vol. 113, no. 18, Nov. 1, 1934, pp. 553–556. Author points out fallacy of ignoring building walls and slabs and proposes simple analysis taking them into account and recognizing dynamic character of forces; numerical examples. Bibliography.

COLUMNS, CONCRETE. Mittig gedrueckte Saeulen. A. Kleinlogel and K. Hajnal-Konyi. Der Eisenbeton in Beispielen n 2. Berlin, Wilhelm Ernst & Sohn, 1933, 52 pp., diagrs., charts, tables. Formulas and diagrams for design of axially compressed reinforced concrete columns, with and without hoop reinforcement, of square, octagonal, or any other cross-section; effect of presence or absence of buckling stresses on design of such columns; numerical examples.

MASONRY MATERIALS, MOISTURE. How Mortars Contribute to Dry Walls. L. A. Palmer. *Arch. Rec.*, vol. 76, no. 5, Nov. 1934, pp. 377–384. Study based on correlation of results obtained by U. S. Bureau of Standards; water-retaining capacity; adaptability of mortars and bricks; bonding efficiency of mortars; minimum tensile strength of brickwork obtained with mortar; strength of brick beams in flexure; volume changes subsequent to hardening; associated mortar properties.

SHELLS, STRENGTH. Strength of Thin Shells Subject to External Fluid Pressure. J. Gilson. *Engineering*, vol. 138, no. 3580 and 3591, Oct. 26, 1934, pp. 432–433, and Nov. 9, pp. 503–504. Theoretical mathematical treatment of cylindrical and spherical shells, each being studied separately; summary of practical application.

STATICALLY INDETERMINATE STRUCTURES. Application de la plasticite au calcul des systemes hyperstatiques. J. Verdeyen. *Ossature Metallique*, vol. 3, no. 9, Sept. 1934, pp. 445–453. Theoretical mathematical discussion illustrating application of theory of plasticity to analysis of stresses in statically indeterminate structures. Bibliography.

Theory of Influence Equations. T. Mikuriya. *Civ. Eng. Soc. Japan—Journal*, vol. 20, no. 9, Sept. 1934, pp. 1051–1059. Application of author's influence equations to analysis of fixed arch tested by W. M. Wilson at University of Illinois Experiment Station and of rings tested in 1908 by Talbot at same station. (In English.)

STRESSES, ANALYSIS. Sur la répartition des contraintes élastiques autour d'un point. P. Dévédec. Brussels, Imprimerie Veuve Monnom, 1934, 23 pp., figs., diagrs., charts, tables. Theoretical mathematical analysis of distribution of elastic constraints around the point; equilibrium of elementary sector; components of constraints; principle of reciprocity; applications of theory to various problems in applied mechanics.

TRUSSES, CONCRETE. Sforzi secondari nelle travature a traliccio in cemento armato. L. Santarella. *Politecnico*, vol. 82, no. 2, Feb. 1934, pp. 75–81. Mathematical analysis of secondary stresses and elastic deformations observed in tests of through Warren truss of reinforced concrete, 12 m span, made at structural laboratory of Milan Institute of Technology.

TUNNELS

CONSTRUCTION. New Records in Driving Single-Heading Tunnel. S. O. Andros. *Min. & Met.*, vol. 15, no. 335, Nov. 1934, pp. 441–442. Note on progress in driving 3.7-mile tunnel through Continental Divide; tunnel diameter 9 ft 2 in.; east portal was advanced 48 ft during May 1934; equipment features.

FAILURE. Collapse of Breasting Causes Tunnel Cave-in on Sewer Project in Chicago. *Eng. News-Rec.*, vol. 113, no. 21, Nov. 22, 1934, p. 671. Collapse, on Nov. 12, 1934, of breasting at face of south heading of large tunnel, being driven under compressed air for West Side intercepting sewer, which caused cave-in and flooding due to broken water main; tunnel of 17 by 17-ft horseshoe section inside of 17 to 28-in. reinforced concrete lining, is driven through irregular deposits of sand and loam.

WATER PIPE LINES

MAINTENANCE AND REPAIR. Thawing New York State Water Mains. C. A. Holmquist and A. F. Dappert. *Am. City*, vol. 49, no. 11, Nov. 1934, pp. 53–54. Experience of New York municipality during winter 1933–1934; cold-weather conditions; extent of damage due to freezing; relation of depth of cover to freezing of water pipes; increased use of water during cold weather; methods employed in thawing pipes; cost of thawing; difficulties experienced in thawing by electricity.

WATER PUMPING PLANTS

HYDRO-ELECTRIC POWER PLANTS, DRAINAGE. Die selbsttaetige Stollenpumpanlage des Spullersseewerkes. A. Hruschka. *Electrotechnik u Maschinenbau*, vol. 52, nos. 44 and 45, Nov. 4, 1934, pp. 513–515, and Nov. 11, pp. 529–532. Automatic tunnel pumping equipment of Spullersee plant; two electrically driven and automatically controlled pumps, installed in tunnel to drain infiltration water from outside sources and pump it into storage lake to increase useful output during period, April to November; pumps are of single-stage turbine type.

WATER RESOURCES

WATERSHEDS, ITALY. Statistica delle aree dei bacini idrografici. *Ministero dei Lavori Pubblici—Ufficio Idrografico del Po—Parma*, vol. 1, Pt. 1 and 11, 1934. Pt. 1, 95 pp., 2 supp. sheets, and Pt. 11, 106 pp., 3 supp. sheets. Hydrological data on watersheds of following streams north (Italy): Panaro, Secchia, Crostolo, Enza, Parma, Taro, Stirone, Arda, Chero, Riglio, Nure, Trebbia, Tidone, Staffora, Curone, Scrivia, and Bornida; percentage of watershed areas between given contour intervals.

WATER TREATMENT

BREWERIES. Water Purification in Modern Brewery and Distillery. F. J. Lammers. *Indus. & Eng. Chem.*, vol. 26, no. 11, Nov. 1934, pp. 1133–1136. Brewing water; wash and rinsing water; boiler feedwater; cooling water; water flow diagram of brewery; water treatment principles of distillery are similar to those of brewery, but cooling water requirements are larger and more critical; distillery also requires special water for cutting, reducing to proof, and for blending and rectifying purposes; water flow diagram of distillery.

FILTRATION PLANTS. Ueber den Filterbau fuer Trinkwasserversorgungen in den Vereinigten Staaten von Nordamerika. Scherer. *Gas- u Wasserfach*, vol. 77, no. 13, Mar. 31, 1934, pp. 199–203. Review of progress in design and construction of water filtration plants in United States.

IRON REMOVAL. Removal of Iron and Manganese from Water. S. B. Applebaum and M. E. Bretschger. *Indus. & Eng. Chem.*, vol. 26, no. 9, Sept. 1934, pp. 925–931. Difficulties caused by iron and manganese in industry and home; methods of iron and manganese removal; factors interfering with oxidation reactions; types of iron and manganese removal plants; correction factors; effect of excess lime; analyses of water of paper mill; effect of softener treatment; experiences with iron and manganese removal installations. Bibliography.

WATER WORKS ENGINEERING

WATER WELLS. Development of Large Capacity Deep Wells for Tacoma, Washington. W. A. Kunigk. *Am. Water Work Assn—Journal*, vol. 26, no. 7, July 1934, pp. 844–857. Development of five large wells with total capacity of 25 mgd; practibility of underground water supply of large capacity; specifications and details of construction; tests and permanent equipment; electrical and mechanical equipment; costs.

WATER WORKS, DENVER, COLO. Denver Secures PWA Loan for Water Diversion. *Eng. News-Rec.*, vol. 113, no. 23, Dec. 6, 1934, pp. 730–731. $3,500,000 is to be expended on trans-mountain diversion of 54,600 acre-ft of water annually from headwaters of Colorado River through pioneer bore of Moffat railroad tunnel, providing irrigation supply for lower valley in exchange for water taken by city from upper South Platte River.

THOSE COLD SPRING NIGHTS

—No Hazard with 'Incor'

AS SPRING approaches, the dependable high early strength of 'Incor' 24-Hour Cement is doubly important. Concrete is cool when placed—much cooler than mid-day air temperatures. As a result, ordinary concrete hardens but little the first night, is exposed to risk of sudden temperature drop. To be on the safe side, full Winter heating and protection methods are necessary, even when days are warm and sunny.

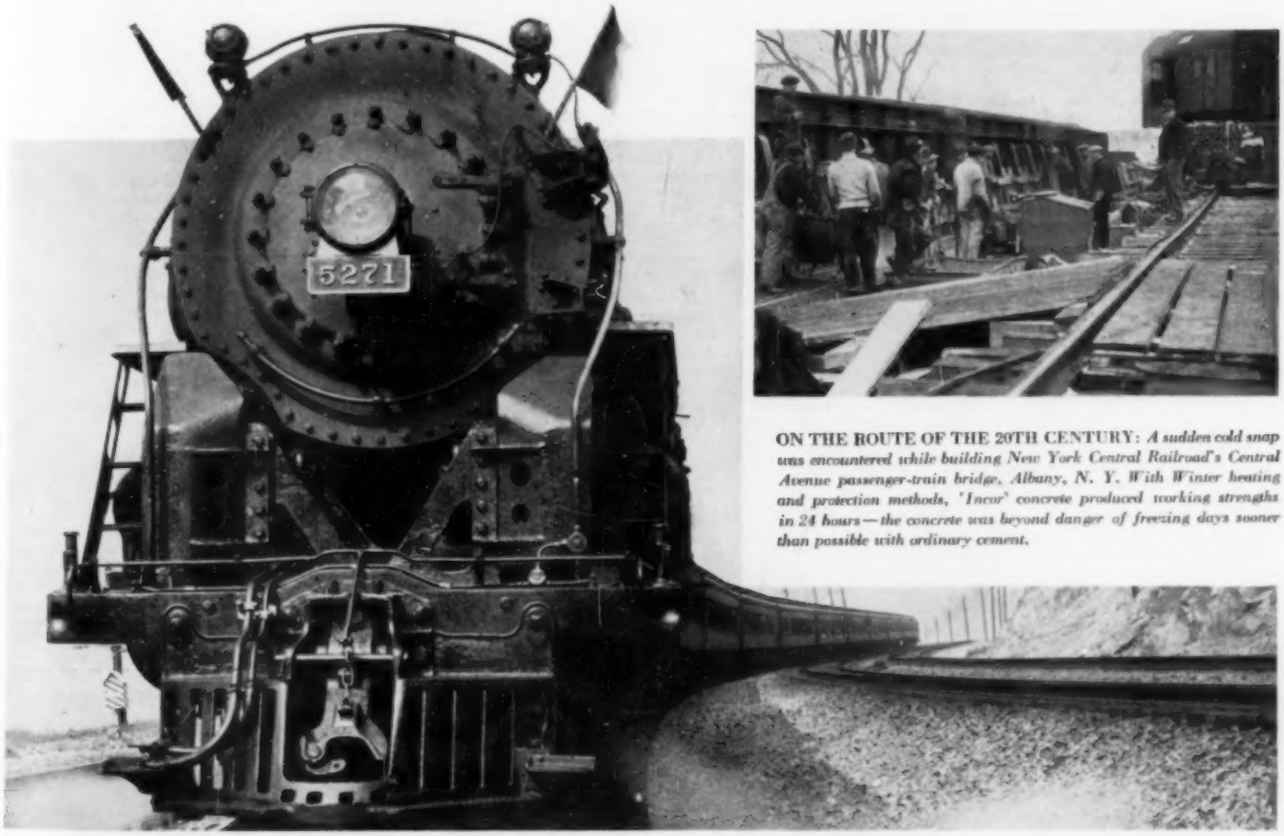
The Cold-Night Problem Solved

With 'Incor' it is usually sufficient to heat mixing water and promptly protect the placed concrete against heat loss. 'Incor' is beyond danger of freezing days sooner than ordinary concrete. Heating and protection problems are simplified, costs reduced. If overnight service strengths are desired, supply adequate heat between sunset and sunrise.

For example, while constructing New York Central Railroad's Central Avenue passenger-train bridge, Albany, N. Y., last Fall, the contractor ran into sub-freezing weather. 'Incor' concrete, heated to 92°, was placed in forms and against steel breast-wall in late afternoon, air temperature 27°. Steam from a crane used on the job was carried under tarpaulins by 3" pipe, with outlet valves at 10' intervals. Night air temperatures dropped to 20°—but at 9 a. m. next morning form removal began. 'Incor' attained working strength within 24 hours.

Use 'Incor' This Spring

Why not keep 'Incor's' cold-weather advantages in mind, in the coming weeks, when Spring, with its treacherous temperature changes, presents a constant frost hazard. 'Incor'* is made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York; also sold by other cement manufacturers. *Reg. U. S. Pat. Off.



ON THE ROUTE OF THE 20TH CENTURY: *A sudden cold snap was encountered while building New York Central Railroad's Central Avenue passenger-train bridge, Albany, N. Y. With Winter heating and protection methods, 'Incor' concrete produced working strengths in 24 hours—the concrete was beyond danger of freezing days sooner than possible with ordinary cement.*

'INCOR' 24-Hour Cement

neering; 1 year as assistant in civil engineering office; 1 year as traffic surveyor; limited experience in surveying; desires opportunity in any branch of civil engineering. Available immediately. Location immaterial. Excellent references. D-3616.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; single; B.S. in C.E., University of Washington, 1933. Majored in structural design; 4 months as rodman—chainman; 4 months as painting inspector; neat and accurate draftsman. Desires opportunity in any branch of civil engineering. Available immediately. Location immaterial. D-3554.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; C.E. degree, Rensselaer Polytechnic Institute, 1933; postgraduate scholarship at R. P. I., one-half year; 4 months experience on water supply and sewage disposal. Desires position in any field of civil engineering, mainly for experience. Location and salary secondary. D-2308.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; single; B.C.E., recent graduate of the Polytechnic Institute of Brooklyn. Desires chance for practical experience in any branch of civil engineering. Available immediately. Location immaterial. D-3632.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; married; B.S. in C.E., 1933; 2 months distillery drafting; 1 month drafting for power company; 5 months drafting and computing for city reassessment. Interested in construction, drafting, and surveying. Experience main objective. Available now. Location immaterial. D-3025.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Iowa State College, 1934; registered professional engineer, Minnesota and Iowa; 4 years experience as assistant to county engineer. Chief interests: highways, geodesy, municipal engineering, and structures. Type of work and salary secondary. Available immediately. Location in Hawaiian or Philippine islands desired. D-3689.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S., C.E., Duke University, 1933. Majored in design of structural steel and water supply; 1 month with the U. S. Coast and Geodetic Survey; 3 months experience, water and sewage works; 3 years as inspector of telephone apparatus. Desires opportunity in any branch of civil engineering. Location immaterial. Available immediately. D-2683.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; single; B.E. in C.E., Tulane University, 1927; Louisiana state licensed C.E.; 5 months steel detailer; 1 year as transitman on survey and construction; 6 years as assistant engineer in charge of city surveys, municipal engineering, paving, drains, and sewers. Available now. Location in the United States. D-3676.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 29; B.S., 1928 and C.E., 1929, College of the City of New York; 6 months as field instructor of surveying; 1 year computing final estimates; 6 months checking others' estimates; 2 months on field highway work; 3 years in field and office work on water tunnel project, line and grade work; 6 months as instrumentman on survey of city streets. Location immaterial. Available immediately. D-3639.

JUNIOR CIVIL ENGINEER; Jun. Am. Soc. C.E.; 4 years experience as transitman on maps and computations on highway, waterway, and underground projects. Record includes New York Central and U. S. Gypsum Company assignments. Qualified for junior engineer in U. S. Coast and Geodetic Survey. Single, citizen, age 30, ablebodied, good eyesight. Will go anywhere except tropic lowlands. C-6530.

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; graduate of Tulane University; single; 28; 4 years engineering and construction experience, on wharves, railroads, ship channel, levees, and bridges; 1 year with operating company. Excellent references. Desires responsible position with established firm. Available on one month's notice, to go anywhere. D-3692.

CONCRETE TECHNICIAN; Jun. Am. Soc. C.E.; 25; B.S. in C.E. and M.S., Lehigh University; majored in concrete with minor in business administration; over 2 years experience in highway construction; experience in materials testing and supervision. Desires teaching or commercial position in concrete or materials testing. Available on short notice. D-2874.

SALES

ENGINEER-EXECUTIVE; M. Am. Soc. C.E.; registered in Pennsylvania; supervision of engineering, estimating, sales, and plant operations. Steel fabrication and general contracting. Available immediately. C-5095.

TEACHING

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; married; B.S. from Yale University; M.S. from Massachusetts Institute of Technology; 1½ years complete preliminary surveying experience, also some construction work. Over 1 year experience teaching mathematics in industrial high school in New York City. Desires teaching position in an engineering school. D-1050.

INSTRUCTOR—Mathematics and physics in either college or high school. Holds degree of B.S. in C.E. and is obtaining M.A. in Education at New York University. State teaching license by June 1935. Christian; 24 years old; will furnish references. Has done athletic coaching. (Student) D-3559.

RECENT BOOKS

New books of interest to Civil Engineers, donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 75 of the Year Book for 1934. These notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

AIR CONDITIONING SIMPLIFIED, Theory, Practice, and Marketing. Edited by H. L. Alt. Chicago, Domestic Engineering Co., 1934. 215 pp., diagrs., charts, tables, 9 × 5 in., cloth, $1.

This book, compiled from articles published in *Domestic Engineering*, is intended for the heating and ventilating contractor. The first section presents the fundamental theory of air conditioning and the methods of calculation used in designing installations; the second describes a variety of actual installations in residences and shops; and the third discusses selling methods.

BAUTECHNISCHER LUFTSCHUTZ. By H. Schoszberger. Berlin, Bauwelt Verlag, 1934. 240 pp., illus., diagrs., maps, charts, tables, 9 × 6 in., cloth, 7.80 rm.

As methods of aerial warfare develop, the problem of protecting buildings and cities from attack becomes important to the architect and engineer. Methods for protecting buildings from explosive and incendiary bombs, poisonous chemicals, and bacterial bombs are discussed. The construction of bomb-proof rooms and buildings is described, and a section is devoted to city planning for safety from aerial attack. An extensive bibliography is given.

Great Britain. Department of Scientific and Industrial Research. Report of the FOREST PRODUCTS RESEARCH BOARD, 1933. London, His Majesty's Stationery Office; (obtainable from British Library of Information, New York, N.Y.) 1934. 67 pp., illus., charts, maps, 10 × 6 in., paper, 1s. 3d.; 45 cents.

A concise summary of the investigations in progress during 1933 at the Forest Products Research Laboratory. These were concerned with a great variety of matters of scientific and industrial interest, such as methods of seasoning timber, timber preservatives, the chemistry of decay, and insect damage.

Great Britain. Department of Scientific and Industrial Research. Report of the Committee on the MECHANICAL TESTING OF TIMBER. London, His Majesty's Stationery Office; (obtainable from British Library of Information, New York, N.Y.) 1934. 41 pp., illus., diagrs., charts, 10 × 6 in., paper, 1s.; 35 cents.

This committee was charged with a review of the testing of timber for strength and elasticity. It has examined critically the methods used in the Forest Products Research Laboratory and the tests prescribed in the British Standard Specifications, which are in the main those of the American Society for Testing Materials. The report summarizes the work of the committee and gives its conclusions as to the value of the different tests.

MISSOURI STATE PLANNING BOARD. PRELIMINARY REPORT ON A STATE PLAN FOR MISSOURI. Missouri State Planning Board, Capitol Bldg., Jefferson City, Mo., July 1934. Illus., maps tables, charts, 12 × 9 in., paper, $1.

The Missouri State Planning Board was appointed on December 29, 1933, and this report covers the results of eight months of functioning. After an introductory sketch of the history of the state, the report presents factual information upon its physical characteristics, land use, population, natural resources, industry, transportation, parks, social institutions, etc. Certain tentative suggestions for improvements are made, preliminary to a definite program.

MODEL LAWS FOR PLANNING CITIES, COUNTIES, AND STATES, INCLUDING ZONING, SUBDIVISION, REGULATION AND PROTECTION OF OFFICIAL MAP. By E. M. Bassett, F. B. Williams, A. Bettman, and R. Whitten. Cambridge, Mass., Harvard University Press, 1935. 137 pp., 10 × 7 in., cloth, $2.50.

This is the latest addition to the series of studies issued by the Harvard University School of City Planning. It contains two sets of model laws for planning, prepared by Messrs. E. M. Bassett and F. B. Williams, and by Mr. Alfred Bettman, with a discussion and suggested changes by Mr. Robert Whitten. These model laws and the discussion by these experienced students should prove helpful to all engaged in planning and zoning.

MUNICIPAL INDEX AND ATLAS. 11 ed. New York, American City Magazine Corp., 1934. 527 pp., illus., diagrs., maps, tables, 10 × 7 in., leather, $5.

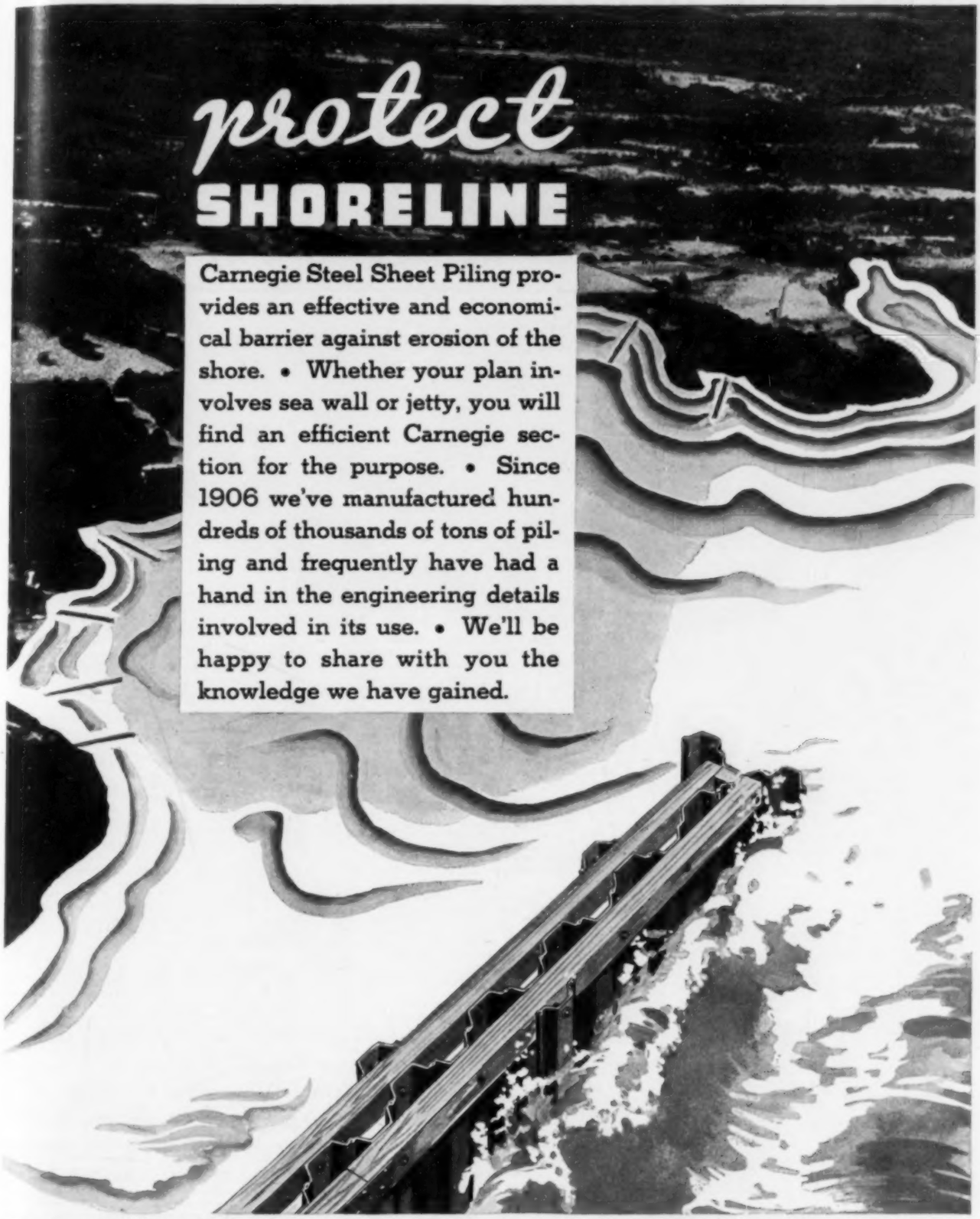
This well-known year book is intended for state and municipal engineers interested in highways, water supplies, sewage, lighting, public safety, parks, etc. It contains directories of municipal officials, practical articles on various matters of municipal engineering, catalogs of manufacturers, lists of consulting engineers, and similar information. The atlas shows all incorporated places in the United States and Canada.

RESISTANCE OF MATERIALS. By F. B. Seely. 2 ed. New York, John Wiley & Sons, 1935. 436 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $3.75.

While the purpose of this book—to provide a text for the standard college course in the subject—has been kept, the work has been revised and rearranged, and is entirely reset. The first part covers the usual undergraduate course, and the second part treats briefly some special topics in stress analysis of more advanced character. In this edition special emphasis is given to the engineering significance of the subject, not merely to mathematical methods of analysis.

STAURAUMVERLANDUNG UND KOLKABWEHR. By A. Schoklitsch. Vienna, Julius Springer, 1935. 178 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 19.50 rm.

The purpose of this book is to throw light on some important questions that confront the designer of reservoirs and hydraulic power plants. These are the transportation of debris by running water, the silting up of reservoirs, erosion below dams, and the dissipation of energy. Dr. Schoklitsch presents the results of extended experimental studies, supplemented by the work of other investigators, in a form for practical use. Bibliographies accompany each chapter.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BRIDGES

CAST IRON. Gusseisen im Brueckenbau. E. Ellmer. *Giesserei*, vol. 21, nos. 37/38, Sept. 14, 1934, pp. 398–399. Cast iron in bridge construction; first cast-iron bridge in Germany built in 1794; cast iron not used in German bridge construction after 1868; through development of von Emperger system of concrete columns with hooped cast-iron cores; cast iron has recovered its standing as high-grade structural material.

CONCRETE ARCH. Die Grundlagen fuer den Fortschritt und die Grenzen im Bau weitgespannter gewoelbter Bruecken, Gaede. *Bauingenieur*, vol. 15, nos. 13/14 and 17/18, Mar. 30, 1934, pp. 119–122, and Apr. 27, pp. 182–185. Analytic study of engineering and economic limits of long-span, reinforced-concrete arch bridges leading to conclusion that, under German conditions, economic limit may be between 120 and 200 m.

HIGHWAY SUBMERGIBLE. Submergible Road Bridge Over Nerbudda River Near Jubbulpore, India. A. W. H. Dean. *Engineering*, vol. 138, no. 3596, Dec. 14, 1934, pp. 649–650. Bridge replaces ferry during rainy season and temporary wooden structure for rest of year; designed to be overtopped, without suffering any serious damage, by occasional very high flood; consists of eight arches of 46-ft clear span and 6 spans of 98 ft in central length; length 1,222 ft. Before Instn. Civ. Engrs.

PETROLEUM PIPE LINES, RIVER CROSSINGS. Pipe Line Bridge Recently Built Featured by Construction Design. F. Swindell. *Oil Weekly*, vol. 75, no. 2, Sept. 24, 1934, pp. 31–32. Bridge designed to carry one 8-in., one 10-in., and one 12-in. welded line over span of 210 ft across Big Hominy Creek on main trunk line of Stanolind Pipe Line Company; towers are 240 ft apart; suspension cables 1⅛ in. in diameter made of single-strand, galvanized, plow steel wire; major portions of structure are fabricated from pipe reconditioned from other uses.

RAILROAD MAINTENANCE OF WAY. Committee XII—Rules and Organization. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 367–368, July–Aug. 1934, pp. 106–109. Rules for inspection of bridges, trestles, and culverts, for maintenance of bridges and for fire prevention as applying to maintenance-of-way department; appropriate titles for assistant engineers.

RAILROAD STRESSES. Impact in Railway Bridges—Retrospect and Present-Day Aspect. C. Gribble. *Instn. Civ. Engrs.—Instn. Lecture to Students session*, 1932–1933, 26 pp. Review of work by British Board of Trade; Woehler's experiments; B. Baker's views; researches in 20th century; Pencoyd formula; experiments in United States; hammer-blow of locomotives; tests in India; Continental practice; work of Bridge Stress Committee; Inglis's formulas for semi-amplitude of maximum oscillation; present position.

STEEL, STRESSES. Limiting Deflection of Steel Highway Bridges. J. F. Pain. *Civ. Eng. (London)*, vol. 29, no. 335, May 1934, pp. 159–160. Dead-load deflections; effects of deflection; static and dynamic deflections.

STEEL TRUSS. Auswechslung der Saalebruecken bei Grossheringen, Kilian. *Bautechnik*, vol. 12, nos. 2 and 4, Jan. 12, 1934, pp. 17–20, and Jan. 26, pp. 46–49. Reconstruction of steel-truss superstructure of bridge over Saale, at Grossheringen, Germany, having six spans, from 36 to 77 m. in length.

STEEL TRUSS, GERMANY. Die Donaubruecke bei Walhallastrasse, H. Wittenzellner. *Bauingenieur*, vol. 15, nos. 7/8 and 9/10, Feb. 16, 1934, pp. 67–72, and Mar. 2, pp. 84–89. Construction of new superstructure, consisting principally of five through Warren trusses, 49.2 m in span, for 2-track railroad bridge over Danube River at Regensburg, Germany; details of steel erection.

STEEL TRUSS, STRENGTHENING. Die Verstaerkung der Fahrbahntraeger der Eisenbahnbruecke ueber die Donau bei Ujpest (Ungarn), Koranyi. *Bautechnik*, vol. 12, nos. 18, and 19, Apr. 27, 1934, pp. 235–238, and May 4, pp. 248–251. Method of strengthening trusses of Danube railroad bridge at Ujpest, Hungary, consisting of seven spans, each 92 m long; tests of original steel used in 1896; static analysis of modified steel trusses.

STEEL, WELDING. Geschweisste Eisenbahnbruecken, Leopold. *Bautechnik*, vol. 12, no. 17, Apr. 20, 1934, pp. 223–226. Recent practice in welding of short-span railroad bridges; structural details of four bridges of this type.

SUSPENSION, AUSTRIA. Der Umbau der Reichsbruecke, J. Wagner. *Zeit des. Oesterreichischen Ingenieur u Architekten-Vereines*, vol. 86, nos. 1/2, Jan. 12, 1934, pp. 9–11. Results of competition for design of suspension bridge over Danube River at Vienna, Austria, with span of 243.5 m, estimated to cost 24,000,000 Austrian shillings.

BUILDINGS

MOVING PICTURE THEATERS, SOUNDPROOFING. L'isolement acoustique des cinémas sonores, J. Katel. *Technique cinématographique*, vol. 5, no. 46, Oct. 1934, pp. 266–268. Acoustic insulation in moving picture theaters; outline of procedure and materials used on basis of cross-sectional drawings of actual moving-picture theaters.

RAILROAD BUILDINGS, SPECIFICATIONS. Committee VI—Buildings. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, nos. 367–368, July–Aug. 1934, pp. 39–49. Revised specifications for built-up roofing.

SUBSIDENCE. Verbesserte Schlauchwaage zur Setzungsbeobachtung, K. von Terzaghi and K. Langer. *Bautechnik*, vol. 12, no. 23, June 1, 1934, pp. 291–292. Description of improved device for measuring subsidence of buildings; consists principally of two glass tubes connected by means of hose, not over 25 m long, filled with liquid.

TELEPHONE BUILDINGS. Unique Exchange Building. A. O. Black. *Telephone Engr.*, vol. 38, no. 12, Dec. 1934, pp. 15–16. Insulated steel building at North Washington, Pa., is highly fire-resisting, and telephone company succeeded in getting extremely low insurance rate.

WIND EFFECT. L'action du vent sur les batiments, L. J. Vandeperre. *Annales des Travaux Publics de Belgique*, vol. 35, no. 2, Apr. 1934, pp. 199–242, 2 supp. plates; vol. 35, no. 4, Aug. 1934, pp. 521–553. Determination of effect of wind on building and walls by experimental aerodynamics; measurement of wind velocity. Observations on gales and wind velocity measurements at Plougastel Bridge, Eiffel Tower, etc.; variation of wind intensity with altitude and photography; wind tunnel tests of models of engineering structures and their members. Bibliography.

CONCRETE

BEAMS. Das Verhalten von Eisenbeton-T-Balken unter dem Einfluss dauernd ruhender und haeufig wiederholter Belastung, F. Treiber. *Bauingenieur*, vol. 15, no. 13/14 and 17/18, Mar. 30, 1934, pp. 131–133, and Apr. 27, pp. 178–182. Results of tests of behavior of reinforced concrete T-beams under static and under frequently repeated loading.

CANALS, LINING. Boeschungsbeton, sein Schutz und sein Ersatz, F. Joedicke. *Bautechnik*, vol. 12, no. 1, Jan. 5, 1934, pp. 10–15. Use of bituminous coatings and other methods of protecting the concrete linings of navigation, power, and other types of canals; use of asphalt compositions in conjunction with masonry instead of concrete lining for canals.

CEMENT KILNS, REFRACTORY MATERIALS. Die Einwirkungen des Brennprozesses auf das Klinkerbetonfutter des Zementdrehofens, K. Krassowsky. *Tonindustrie-Ztg.*, vol. 58, no. 62, Aug. 2, 1934, pp. 746–747. Effects of burning process on clinker-concrete lining of rotary cement kiln; results of analytical and microscopic studies on three different types of brick.

CONSTRUCTION. Die Betonverarbeitung, S. Steuermann. *Beton u Eisen*, vol. 33, no. 6, Mar. 20, 1934, pp. 85–95. Review of modern practice of concrete construction, including design, methods of placing, pumping, tamping, vibrating, determination of viscosity of cement paste, etc. Bibliography.

CONSTRUCTION, COLD WEATHER. Le béton chauffé électriquement, C. Kunz. *Bul. Technique de la Suisse Romande*, vol. 60, no. 6, Mar. 17, 1934, pp. 66–70. Outline of Swedish and Russian systems of concrete construction in cold weather (down to temperature of −20 C) by means of electric heating systems, using steel plate or steel rods for transmission of heat through concrete.

CONSTRUCTION, COLD WEATHER, STEAM. Heating Concrete Aggregates in Open Stock Piles. *Concrete*, vol. 42, no. 10, Oct. 1934, pp. 13–14. Use of improvised furnaces, steam jets, steam-pipe grills, and rotary driers in heating aggregates during winter construction; inadequate capacity is prevailing error.

CONSTRUCTION, FORMS. Holz- oder Stahlschalung? A. Schuler. *Beton u Eisen*, vol. 33, no. 5, Mar. 5, 1934, pp. 76–79. Discussion of wooden versus steel forms for concrete construction illustrated with many examples from German practice, leading to conclusion that both types of formwork are justifiable under proper conditions.

CONSTRUCTION, VIBRATING. Vibratoren fuer Beton. *Tonindustrie-Ztg.*, vol. 58, no. 68, Aug. 23, 1934, pp. 816–817. Vibrators for concrete; brief illustrated description of equipment used for concrete construction by vibration method.

CURING. Further Tests of Cotton Mats for Curing Concrete. *Pub. Roads*, vol. 15, no. 6, Nov. 1934, pp. 231–234. Observations made at Arlington Experiment Farm upon effectiveness of cotton mats of various thicknesses as protection against freezing during sudden drops of air temperature; cotton mats give effective protection during short freezing periods.

DAMS, CONCRETE GRAVITY. Die Verwendung von Thurament beim Bau der Saaletalsperre am Kl. Bleiloch, R. Sommer. *Bautechnik*, vol. 12, nos. 17 and 18, Apr. 20, 1934, pp. 229–232, and Apr. 27, pp. 238–241. Use of substitute for trass, known as "thurament," in proportioning of concrete for Saaletal concrete dam at Kl. Bleiloch, Germany; results of tests of mortar and concrete for strength, temperature effect, shrinkage, etc.

DISINTEGRATION. Resistance of Concrete in Seawater. *Permanent Int. Assn. Navigation Congresses—Bul.*, vol. 9, no. 17, Jan. 1934, pp. 71–84. Review of reports issued in Great Britain, United States, and other countries since 1926.

MIXING. Effect of Amount of Fine Aggregate on Quality of Concrete, J. C. Sprague. *Concrete*, vol. 42, nos. 10 and 11, Oct. 1934, pp. 16–19, and Nov. 1934, pp. 17–18. Discussion of data; effect of over-mortared mixtures; flowability and mobility measured separately; calculation of proportions, where unit weight is important.

RESEARCH. Der neue Hauptarbeitsplan des Deutschen Ausschusses fuer Eisenbeton. *Beton u Eisen*, vol. 33, no. 7, Apr. 5, 1934, pp. 118–120. Outline of program of German Reinforced Concrete Committee for future research in reinforced concrete, including fatigue strength, column tests, elastic and plastic properties, increasing strength of concrete, resistance of concrete to weathering, effect of low temperatures on concrete, buckling of concrete arches, etc.

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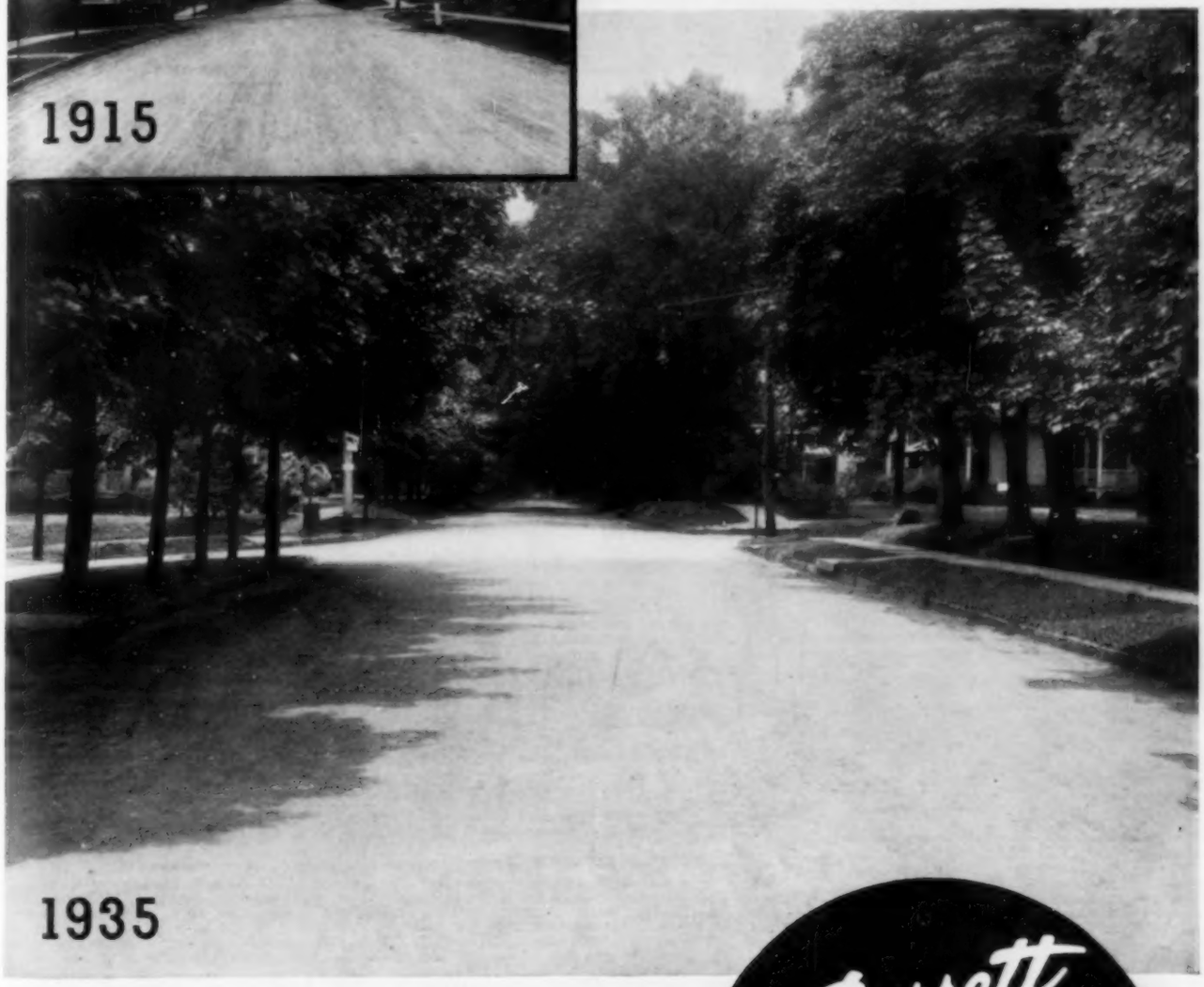

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STRENGTH. Le retrait des ciments, mortiers et bétons, R. Dutron. *Annales des Travaux Publics de Belgique*, vol. 35, no. 2, Apr. 1934, pp. 243–269. Report on original Belgian studies of effect of proportioning of aggregates, nature of materials, richness of cement, and fluidity of mixing on shrinkage of concrete.

SUBWAY CONSTRUCTION, Moscow. Elektrisch beheizter Beton beim Bau der Moskauer Untergrundbahn, A. Réthy. *Beton u Eisen*, vol. 33, no. 4, Feb. 20, 1934, pp. 58–60. Electric wiring and equipment used in heating of concrete in construction of Moscow subway; cost data.

WATERPROOFING. Wasserdichter Beton, V. Baehrner. *Zement*, vol. 23, nos. 34 and 35, Aug. 23, 1934, pp. 492–495, and Aug. 30, pp. 505–508. Waterproof concrete; determination of cement content; water-cement-ratio diagrams; charts showing cement ratio per 1 cu m of concrete and calculated concrete strength after 28 days; ideal curves for sand for production of dense concrete; example of mixture curves, etc.

DAMS

FRANCE. Some Large French Water Dams, M. R. Miche. *Civ. Eng.* (*London*), vol. 29, no. 335, May 1934, pp. 170–176. Review of recent dam design and construction practice in France and French Colonies: examples of low, medium, and high structures.

HYDRAULIC FILL, FORT PECK, MONTANA. Fort Peck Dam on Missouri River, T. B. Larkin. *Am. Water Works Assn.—Journal*, vol. 26, no. 7, July 1934, pp. 874–877. Main features of hydraulic-fill dam of 230-ft maximum height and 20,000-ft total length; purposes of dam; diversion tunnels; spillway; subsurface investigations; town of Fort Peck; water supply; employment.

MOVABLE. Das hydraulische Dachwehr, G. Trossbach. *Bauingenieur*, vol. 15, nos. 19/20, May 11, 1934, pp. 195–198. Recent progress in design of movable shutter weirs; analysis of stresses in automatic weir shutters at various positions.

STEEL STRUCTURES, SUBAQUEOUS. Unterwasseranstriche fuer Stahlbauteile im Wasserbau, Wedler. *Bautechnik*, vol. 12, no. 17, Apr. 20, 1934, pp. 232–234. Use of bituminous and other protective coatings for protection of subaqueous steel members of hydraulic structures, particularly locks and weirs.

WEIRS, DISCHARGE. Experiments on Small Rectangular Weir Without Side Contractions, Y. Shimoyama. *Kyushu Imperial Univ.—Memoirs Faculty Eng.*, vol. 7, no. 4, 1934, pp. 185–207. Report on tests showing effect of displacement of hook-gage scale with reference to crest of weir, temperature of water, measurement of head; Rehbock's formula of 1929 shown to be in comparatively better agreement than others. (In English.)

FLOOD CONTROL

EMBANKMENTS, SEEPAGE. Naeherungsverfahren zur Ermittlung der Sickerung in geschuetteten Daemmen auf unduschlzessiger Sohle, L. Casagrande. *Bautechnik*, vol. 12, no. 15, Apr. 6, 1934, pp. 205–208. Approximate theoretical method for determining quantity of seepage through embankment fills built on impervious sites.

RIVERS, IMPROVEMENTS. La sistemazione idraulica del torrente Agno-Gua e il bacino idraulico di Montebello Vicentino, L. Miliani. *Annali dei Lavori Pubblici*, vol. 72, no. 6, June 1934, pp. 461–494. Erosion control, canalization, and other improvements in course of Agno-Gua creek and in its watershed located northeast of Verona, Italy; features of check dams, siphons, and similar hydraulic structures.

RIVERS, ITALY. River Po. Hydrographical Notes. Methods and Works for Its Regulation. *Permanent Int. Assn. Navigation Congresses—Bul.*, vol. 9, no. 17, Jan. 1934, pp. 51–69. Hydraulics of largest river of Italy; review of levy construction, revetment, and other improvement works.

RIVERS, REVETMENT. Ufersicherungen an der Este und Luehe, Mueller. *Bautechnik*, vol. 12, no. 20, May 11, 1934, pp. 255–257. Description of revetment consisting of wood piling with sand, gravel, and rock fill for protection of banks of the Este and Luehe rivers tributary to the Elbe River in Germany.

FLOW OF FLUIDS

FLOW OF WATER. Formation of Rust Which Shows Configuration of Stream Lines, F. Numachi. *Tohoku Imperial Univ.—Tech. Reports*, vol. 11, no. 3, 1934, pp. 302–306, 9 supp. plates. Discovery of phenomenon of rust formation, which shows exact configuration of streamlines caused by flowing water; this phenomenon, author believes, is useful in photographic study of streamlines; phenomenon revealed by photographs can be applied to flow along complicated boundary, such as helical surface, or flow along boundary that cannot be made transparent. (In English.)

WATER METERS, TESTING. Meter Department Research Laboratory, H. W. Niemeyer, W. F. Lebo and H. G. Horstman. *Am. Water Works Assn.—Journal*, vol. 26, no. 7, July 1934, pp. 819–830. Value of metering; determination of unrecorded water passing through meters; function of laboratory; records; selection and maintenance.

FOUNDATIONS

BEARING PRESSURE. Zulaessige Bodenpressung und Bettungsziffer, E. Jaeger. *Bautechnik*, vol. 12, no. 8, Feb. 23, 1934, pp. 88–91. Review of recent experimental data on bearing power of foundation slabs, with special reference to Hannover tests; variation of bearing power with depth. Bibliography.

FOOTINGS, PRESSURE. Distribution of Soil Pressure Beneath a Footing, F. R. Giesecke, W. H. Badgett and J. R. D. Eddy. *Agric. & Mech. College, Texas—Bul.*, *43*, vol. 4, no. 8, Dec. 1, 1933, 15 pp. Determination of soil pressures under column footing of tower of building on campus of Agricultural and Mechanical College of Texas, using six Goldbeck soil pressure cells; variation of pressure beneath footing during course of erection of building and after its completion; soil beneath footing is clay with small and varying amounts of sand and coarse material. Bibliography.

PILES, DRIVING. Resistance of Piles, G. W. M. Boycott. *Surveyor*, vol. 86, no. 2223, Aug. 31, 1934, pp. 199–200. Review of several European pile-driving formulas; numerical examples.

PILES, STEEL. Der Rammstahlpfahl fuer Pfahlrostbauwerke, Agatz. *Bautechnik*, vol. 12, nos. 5 and 6, Feb. 2, 1934, pp. 56–60, and Feb. 9, pp. 68–71. Recent German experience in driving of H-shaped, concrete-encased steel piles and of steel sheet piling for support of marine structures at Bremen, Germany; experience with wooden and reinforced concrete piles; cost data.

HYDRAULIC ENGINEERING

HYDRAULIC LABORATORIES, NETHERLANDS. Het Waterbouwkundig Laboratorium te Delft, J. T. Thijsse. *Ingenieur*, vol. 49, no. 39, Sept. 28, 1934 (Bouw- en Waterbouwkunde), pp. B175–184. History and description of hydraulic laboratory of Delft, Netherlands, with special reference to model studies; use of luminous floats; list of model testing projects.

RIVERS, HYDRAULICS. Experiments to Determine Backwater Effects of Submerged Sills in St. Clair River, H. D. Vogel. *U. S. Waterways Experiment Station—Paper*, no. 16, Apr. 1934, 57 pp. Price 50 cents. Experiments on effects of proposed sills in St. Clair River, indicating: (1) that it is possible to raise level of Lake Huron by use of sills, and (2) that backwater effects of sills increase as discharge of river is increased; tests of backwater resulting from deeply submerged weirs made by U. S. Lake Survey; comparison of results from distorted and undistorted models.

WATER HAMMER. Note IV sur le coup de bélier, C. Jaeger. *Houille Blanche*, vol. 33, no. 207–208, Mar.–Apr. 1934, pp. 33–37. Notes on water hammer; methods of control of tunnels and pressure conduits, with special reference to armored tunnels and dams; numerical examples.

HYDRO-ELECTRIC POWER PLANTS

GREAT BRITAIN. Hydro-Electric Scheme of Galloway Water Power Company. *Engineering*, vol. 138, nos. 3583, 3586, 3589, 3593, and 3596, Sept. 14, 1934, pp. 267–270 and 280; Oct. 5, pp. 345–347 and 358; Oct. 26, pp. 429–432; Nov. 23, pp. 557–559; and Dec. 14, pp. 639–641 and 652; supp. plates. Details of Tongland portion of scheme; length of arch dam spans river and connects it with straight gravity dam; mass concrete used, no reinforcement being employed; gravity dam 200 ft long; details of gates, fish ladder, spillway, tunnel, power station, etc.

HYDROLOGY, METEROLOGY, AND SEISMOGRAPHY

BUILDINGS, EARTHQUAKE EFFECT. Folgen der Erdbeben in der Krim und die Wiederaufrichtung der Gebaeude, M. J. Ewdokimow-Rokotowsky. *Bautechnik*, vol. 12, no. 6, Feb. 9, 1934, pp. 63–67. Effects of earthquakes of 1927, 1928, and 1929 on buildings in Crimean peninsula, U.S.S.R.; methods of repairing damaged buildings.

INLAND WATERWAYS

NAVIGATION, RIVERS. Ueber den Einfluss von Strombrueckenpfeilern auf die Leistung und Wirtschaftlichkeit der Schiffahrt, G. Kempf. *Werft Reederei Hafen*, vol. 15, no. 19, Oct. 1, 1934, pp. 265–268. Influence of bridge piers on efficiency and economy of inland navigation; by means of model tests with cargo motor-boats, engine power required for vessel to pass through narrows and under bridges against current, is determined; it is claimed that regulation of surface drop has great influence on economic river transportation.

PANAMA CANAL. Die Endhaefen des Panamakanals, W. Franke. *Werft Reederei Hafen*, vol. 15, nos. 23 and 24, Dec. 1, 1934, pp. 343–347, and Dec. 15, pp. 358–360. Terminal ports of Panama Canal and rôle of new Madden Dam in increasing efficiency of canal.

RIVERS, IMPROVEMENTS. Die Neckar-Kanalisierung, Vetter. *Werft Reederei Hafen*, vol. 15, no. 17, Sept. 6, 1934, pp. 235–237. Canalization of Neckar River; brief illustrated description of river improvement, branch canals, locks, weirs, etc.

IRRIGATION

CANALS, SILT. Note on Silt Exclusion from Canals—II, C. C. Inglis and D. V. Joglekar. *Gov. Bombay Pub. Works Dept.—Tech. Paper* no. 46, 1933, 45 pp., 2 supp. sheets. Price 4s. First report on experiments with full-width model of Sukkur barrage; design of dynamically similar models in accordance with Lacey's formulas; experiments on "still pond versus open flow," with discharges equivalent to 500,000 cu ft per sec and 350,000 cu ft per sec; scour and silting; effect of opening undersluices to scour out silt from approach channels.

INDIA. Development of Irrigation in Deccan Canal Areas, C. C. Inglis and V. K. Gokhale. *Gov. Bombay Pub. Works Dept.—Tech. Paper* no. 49, 1934, 47 pp., 14 supp. sheets and maps. Price 3s. 6d. Soil formation and rainfall; history of development of canal irrigation; effect of canal irrigation on quality and yield of crops; growth of crops under canal irrigation; ameliorating effects of irrigation limitations; future of Deccan irrigation; crop areas on Deccan canals.

LAND RECLAMATION AND DRAINAGE

RECLAMATION OF LAND, ITALY. Die Besiedelung der Pontinischen Suempfe und die dortigen staedtischen Neugruendungen, H. Witmer-Ferri. *Schweizerische Bauzeitung*, vol. 104, no. 7, Aug. 18, 1934, pp. 70–72. Report on settlement of reclaimed Pontine marshes in Italy; eradication of malaria; plans and drawings of new villages and buildings.

MATERIALS TESTING

CEMENT ADMIXTURES, CALCIUM CHLORIDE. Show Reaction of Calcium Chloride on Portland Cement, P. Rapp and L. S. Wells. *Concrete*, vol. 42, no. 10, Oct. 1934, pp. 20 and 22. Progress report on investigation at National Bureau of Standards discloses effect of hydration on heat and on the physical properties of concrete.

CONCRETE TESTING, POROSITY. Die wirksame Flaechenporositaet des Betons, K. Terzaghi and L. Rendulic. *Zeit des Oesterreichischen Ingenieur u Architekten-Vereines*, vol. 86, nos. 1/2 Jan. 12, 1934, pp. 1–9. Effective porosity of concrete; theoretical mathematical discussion supported by experimental data showing that hydrostatic uplift on concrete structures immersed in water may be from two to four times greater than that given by formulas proposed by Fillunger, Kammueller, and Toelke. Bibliography.

ENGINEERING RESEARCH. Das Strassenbauinstitut in Mailand, H. Brandt. *Bauingenieur*, vol. 15, nos. 15/16 and 17/18, Apr. 13, 1934, pp. 165–167, and Apr. 27, pp. 185–187. Description of laboratory of Highway Research Institute of Milan; work done by laboratory; features of original testing apparatus, including plasticity testers, portable concrete beam tester, asphalt testing apparatus, profilographs, etc.

ROADS AND STREETS, WEAR. Aus Untersuchungen ueber die Reibung von Kraftwagenreifen auf Strassen, etc, O. Graf. *Beton u Eisen*, vol. 33, no. 1, Jan. 5, 1934, pp. 7–8. Report on laboratory tests of friction of automobile tires on pavements and its effect on wear of road.

STEEL TESTING. Ueber die experimentelle Untersuchung des Tragverhaltens gedrueckter Staebe aus Baustahl, E. Chwalla. *Stahlbau* (*supp. to Bautechnik*), vol. 7, no. 3, Feb. 2, 1934, pp. 17–19. Experimental study of strength of steel bars centrally or eccentrically compressed along their axes.

TESTING. Festigkeit von Moerteiplatten aus hochwertigem Zement, E. Gaber. *Beton u Eisen*, vol. 33, no. 9, May 5, 1934, pp. 144–146. Tests of small mortar slabs made of high-grade cement showing far greater strength than that of laboratory prisms made of same material; effect of reinforcement; fracture phenomena.

PORTS AND MARITIME STRUCTURES

ASCHAFFENBURG. Der neue Hafen Aschaffenburg, Kleiber. *Werft Reederei Hafen*, vol. 15, no. 17, Sept. 6, 1934, pp. 231–233. New inland harbor at Aschaffenburg, Germany; brief account of work begun shortly before war and completed in 1921; with view to transhipment of raw materials and coal.

BUENAVENTURA, COLOMBIA. Construction of Port of Buenaventura, Colombia, J. J. Collins. *Naut. Gaz.*, vol. 124, no. 25, Dec. 8, 1934, pp. 5–9. Port characteristics and facilities; cargo handling equipment; construction problems; economic results of construction executed; traffic facilitated.

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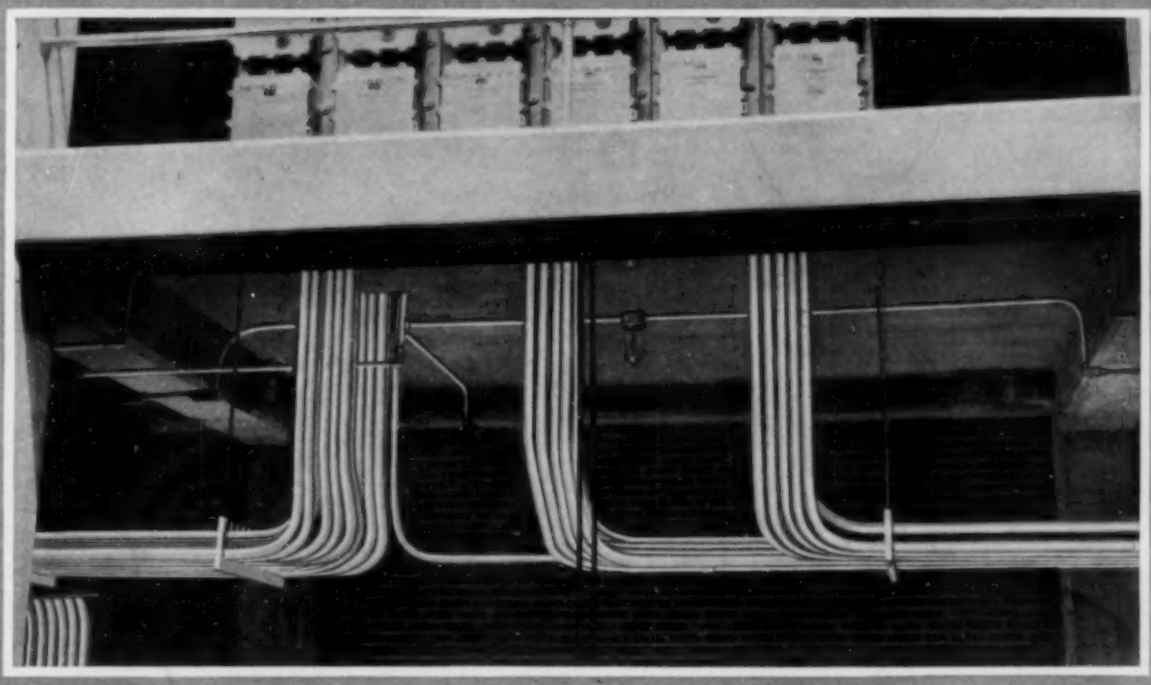

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CARIBBEAN SEA. Bemerkenswerte Hafenplaetze des Karibischen Meeres, W. Franke. *Werft Reederei Hafen*, vol. 15, no. 17, Sept. 6, 1934; pp. 237–243. Noteworthy harbors of Caribbean Sea; impressions gained by author during visit in 1934 to 13 ports; maps and illustrations.

GERMANY. Bericht ueber die auf der Hauptversammlung der Hafenbautechnischen Gesellschaft gehaltenen Vortraege. *Werft Reederei Hafen*, vol. 15, no. 20, Oct. 15, 1934, pp. 283–293. Abstracts of papers read at annual meeting of German Society of Port Engineer: Harbors of Rhine-Main Industrial District, Lingnau; New Types of Cranes, O. Wundram; Experiences with Steel Piles, Hacker; Experiences with Steel Sheet Piling in Construction of Quay-Wall Reinforcements in Hamburg Harbor, H. Benrath.

JETTIES, CONCRETE. Permeable Pre-cast Concrete Jetties Designed to Prevent Scour, S. M. Wood. *Concrete*, vol. 42, no. 12, Dec. 1934, pp. 3–4. Sandy beaches created at Kenosha through control of shore currents; open construction reduces velocity of current without diversion; basic principles of jetty construction.

OAKLAND, CALIF. Port of Oakland, Calif. *Pac. Mar. Rev.*, vol. 31, no. 12, Dec. 1934, pp. 357–360. Notes on harbor construction as outlined by board of consulting engineers; recommendation concerning administration of port.

PIERS, BALTIMORE. Pennsylvania Builds Large Modern Marine Pier at Baltimore. *Ry. Age*, vol. 97, no. 25, Dec. 22, 1934, pp. 820–823. Double-deck, fireproof structure, which will accommodate four ships at time, has concrete pile foundation and unusually complete fire-protection system; sectional illustrations; general plan of first floor of pier, showing service tracks and wide column spacing.

SAN FRANCISCO. Port of San Francisco, P. W. Meherin. *Pac. Mar. Rev.*, vol. 31, no. 12, Dec. 1934, pp. 367–368. Notes on recent maintenance and expansion.

SHORE PROTECTION. Die chinesische Wollhandkrabbe als ein Schaedling der Ufer und Kuesten, N. Peters. *Bautechnik*, vol. 12, no. 7, Feb. 16, 1934, pp. 73–74. Disintegrating effect of tunneling variety of Chinese crab, prevalent in German waters, on river banks, and sea coasts.

THREE RIVERS, QUEBEC. Port of Three Rivers. *Nat. Gas.*, vol. 124, no. 26, Dec. 22, 1934, pp. 5–6. Located at upper limits of the St. Lawrence; adequately equipped with modern facilities for handling inland and ocean shipping; port characteristics and outstanding features; pulpwood center of world.

ROADS AND STREETS

BELT. Belt Road Being Build Around St. Louis. *Eng. News-Rec.*, vol. 113, no. 23, Dec. 6, 1934, pp. 723–725. Description of new route 77, designated Lindbergh Highway, forming semicircle around city and tying together all highways from north, south, and west; four grade-separation structures built, others under way; details of types of grade-separation structures.

BRICK. Vom Unterbau und von der Herstellung des Klinkerpflasters, W. Ostendorf. *Tonindustrie-Ztg.*, vol. 58, no. 70, Aug. 30, 1934, pp. 830–831. Notes on subgrade and construction of brick pavement; it is claimed that vitrified brick surface in cement mortar is suitable for heavy traffic and high speeds.

CONCRETE, CONSTRUCTION. Fehler und Fehlerquellen im Betonstrassenbau, Streit. *Beton u Eisen*, vol. 33, no. 7, Apr. 5, 1934, pp. 113–116. General discussion of faults frequently made in construction of concrete highways.

CONCRETE, MOVEMENT. Bewegungsfugen in Betonstrassen, E. Neumann. *Beton u Eisen*, vol. 33, no. 4, Feb. 20, 1934, pp. 53–58. Observations on movement of reinforced concrete road slabs; design and construction of concrete road joints, with special reference to British, American, and German practice.

CONCRETE, SELECTION. Brueckenbauwerke der Autostrasse Bonn—Koeln—Dusseldorf, Pirlet. *Bauingenieur*, vol. 15, nos. 15/16, Apr. 13, 1934, pp. 150–153. Rules for selection of road materials and for design and construction of concrete roads in light of many years of experience in highway laboratory and of observations on experimental roads.

CULVERTS, CONCRETE. Die Technik der Betonrohrdurchlaesse im Strassenbau, E. Marquardt. *Beton u Eisen*, vol. 33, no. 2, Jan. 20, 1934, pp. 25–30. Design of reinforced concrete culverts for road drainage, based largely on experimental studies made in the United States by Marston, Spangler, and others.

HIGHWAY SYSTEMS, GERMANY. German Autobahns and Roads in the Making, K. Kruger. *Roads & Road Construction*, vol. 12, no. 143, Nov. 1, 1934, pp. 370–372. Organization and administration of system of automobile highways of Germany totaling 6,900 km; constructional features; subgrades and surfaces; laying out; administration of country roads; Reich road regulations.

HIGHWAY SYSTEMS, WESTPHALIA. Plangestaltung und Ausbau eines zwischengemeindlichen Hauptverkehrsstrassennetzes im rheinisch-westfaelischen Industriegebiet, B. Heller. *Bauingenieur*, vol. 15, nos. 17/18, Apr. 27, 1934, pp. 171–177. Planning and construction of 770 km of roads for highway system of Rhine-Westphalia industrial region, Germany, which will have total of 1,660 km of modern roads.

RAILROAD CROSSINGS, CONSTRUCTION. Committee IX—Grade Crossings. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 367–368, July–Aug. 1934, pp. 55–59. Specifications for preparation of track structure, width of crossing, and approaches for construction of street crossings over railway tracks, rail type street crossings, and wooden-plank street crossings; proper vertical curves on highways for grade separation projects.

RAILROAD CROSSINGS, PROTECTION. Highway Crossing Protection of Barrier Type, *Ry. Signaling*, vol. 27, no. 10, Oct. 1934, pp. 490–492, and 494. New type of crossing protection, consisting of barriers which rise in highway, 50 ft from railroad track, installed on Grand Trunk Western near Valparaiso, Ind., controlled automatically by track circuit; features of device, known as "Autostop," and control circuits.

ROAD MACHINERY, GERMANY. Die neuere Entwicklung der Strassenbaumaschinen und Vorrichtungen, A. Bonwetsch. *Bauingenieur*, vol. 15, nos. 15/16 and 17/18, Apr. 13, 1934, pp. 163–165, and Apr. 27, pp. 187–190. Review of recent developments in German road construction equipment; features of excavators, road rollers, tampers, concrete pavers, etc; manual labor versus machinery; layout of road construction plants. Bibliography.

ROAD MATERIALS, EMULSIONS. International Agreement on Testing of Road Emulsions, P. E. Spielmann. *Roads & Road Construction*, vol. 12, no. 143, Nov. 1, 1934, pp. 374–377. Progress report and specifications of test for water content; inhomogeneity of dispersion; storage stability (short-period test); storage stability (long-period test); test for coagulation of emulsion at low temperature; test for viscosity; test for rate of break of emulsion on road (lability test).

RUBBER. Rubber Roads, T. H. Chapman. *India-Rubber Journal*, 50th Anniversary Issue, 1934, pp. 35–36. More successful areas of rubber block paving laid in public streets given in chronological order; latest example is in Mersey Tunnel, where 2,000 sq yd of rubber paving and over 7 miles of rubber division and traffic lines have been laid with improved "Gaisman" rubber cap, based on cast iron, full depth of blocks being only $1^3/_4$ in.

SOVIET UNION. Low Cost Methods of Road Building and Maintenance in U.S.S.R., M. M. Ivanov and M. Shkadow I. K. *Permanent Int. Assn. Road Congresses—Bul.*, vol. 23, no. 94, July-Aug. 1934; pp. 208–218. Statistical data on highway system of U.S.S.R.; improvement of earth roads; gravel road; mechanization of construction of low-cost roads; earth road maintenance.

STEEL. Portable Steel Road. *Engineer*, vol. 158, no. 4116, Nov. 30, 1934, p. 547. Form of construction developed primarily for military purposes which, it is claimed, can be rapidly laid over soft or marshy ground; method makes use of series of pressed steel channels laid transversely to length of road and made so that flange of one channel interlocks with adjacent flange of next.

SUBSOILS. Strassenbauprobleme in Schluff- und Loessgebieten, A. Scheidig. *Bauingenieur*, vol. 15, nos. 15/16, Apr. 13, 1934, pp. 148–149. Specific problems of road design and construction in silt and loess soils, with special reference to freezing; experience in Germany, the United States, and U.S.S.R.

SEWERAGE AND SEWAGE DISPOSAL

DYEHOUSES, WASTE UTILIZATION. Dyeworks Effluent Purification, A. J. Hall. *Am. Dyestuff Reporter*, vol. 23, no. 25, Dec. 3, 1934, pp. 661–664 and 666. Methods of purification successfully employed in purification plant; purification system used yielded effluent having satisfactory characteristics.

PLANTS, EQUIPMENT. Gasoline-Electric Sludge-Bed Cleaner, H. J. Sauvage and J. P. Mulligan. *Elec. Journal*, vol. 31, no. 12, Dec. 1934, pp. 468–470. Sanitary District of Chicago, in fall of 1931, installed motor-driven sludge-bed cleaner; cleaner is interesting not only in that it produced tremendous annual savings but also because of electrical and welding problems encountered in its construction; cleaner, weighing 65 tons, receives its primary power from gasoline-engine-driven generator and can remove 3,000 cu yd daily; welded construction used throughout.

SEWERS, CONCRETE. Concrete Sewer Pipe Has Long Record of Successful Performance. *Concrete*, vol. 42, no. 9, Sept. 1934, pp. 9–10. Milwaukee installs 900 miles of pipe in 30-year period; false and misleading propaganda fails to stop progress; made according to the specifications of the American Society of Testing Materials; long records of successful use.

STRUCTURAL ENGINEERING

ARCHES, DESIGN. Die Variation der Bogenachse, R. Grabner. *Bauingenieur*, vol. 15 nos. 11/12, Mar. 16, 1934, p. 111. Formulas for effect of variation of axis of arch to facilitate preliminary approximate design of hingeless arches.

BRIDGES, RAILROAD, STRESSES. New Impact Formulas of Committee XV, B. R. Leffler. *Am. Ry. Eng. Assn.—Bul.* vol. 36, no. 366, June 1934, pp. 1–13. Experiments by various authorities; general principles and formulas underlying final formulas; single-track bridges alone considered.

GIRDERS, STRESSES. Die Stabilitaet der Blechtraegerstehbleche im zweiachsigen Spannungszustand, O. Stein. *Stahlbau* (*supp. to Bautechnik*), vol. 7, no. 8, Apr. 13, 1934, pp. 57–60. Mathematical discussion of stability of webs of steel-plate girders subjected to simultaneous biaxial stresses; review of such stresses in several plate-girder bridges of recent construction.

TRAFFIC CONTROL

HIGHWAY TRAFFIC SURVEYS. Short Count Traffic Surveys and Their Application to Highway Design, M. McClintock. Chicago, Portland Cement Association. Highway Planning and Design Series no. 3, 1934. 41 pp., figs., diagrs., charts, tables. Outline of method in which traffic is counted for only two 1-hour periods instead of for 24-hour periods and is converted into 24-hour totals by using factors derived from 24-hour counting stations; location of counting station; traffic flow maps; application of traffic volume data; traffic forecasts.

TUNNELS

RAILROAD, DAYLIGHTING. Die Freilegung des Tunnels bei Mainz, Koehler. *Bautechnik*, vol. 12, no. 10, Mar. 9, 1934, pp. 105–108. Method of daylighting 300-m stretch of double-track railroad tunnel at Mainz, Germany, totaling 1,200 m in length, built in 1884; daylighting was ordered for reduction of ventilation and other maintenance and repair costs; other advantages of daylighting.

WATER RESOURCES

AUSTRALIA. Irrigation and Water Supply in Australia, W. G. Sutton. *South African Instn. Engrs.—Journal*, vol. 32, no. 9, Apr. 1934, pp. 175–189 (discussion) 189–191. Climatic and topographical features; water resources; supply of irrigation water in New South Wales; irrigation schemes; irrigation and water supply in Victoria; domestic and stock water supplies; irrigation in South Australia; works under construction.

GREAT BRITAIN. Water Supply in England, A. E. L. Chorlton. *Chartered Surveyors' Instn.—Journal*, vol. 14, no. 6, Dec. 1934 (Trans. supp.) pp. 36–80. Review of water resources and history of development of water works of England since seventeenth century; geology of water supply of England; list of wells, their strata and yields; per-capita water consumption data; proposed organization of English water-works district.

NASSAU, BAHAMA ISLAND. Water Scheme for Nassau, Bahamas. *Civil Eng. (London)*, vol. 29, no. 335, May 1934, pp. 177–180. Description of well-water supply for population of 13,000; problem complicated by presence of salt water under strata bearing fresh-water supply.

WATER TREATMENT

ANALYSIS. Significance of Mineral Matter in Water, P. L. Hibbard. *Am. Water Works Assn.—Journal*, vol. 26, no. 7, July 1934, pp. 884–890. Effect of various minerals on properties of water used for drinking, washing, steam generation, irrigation, and manufactures.

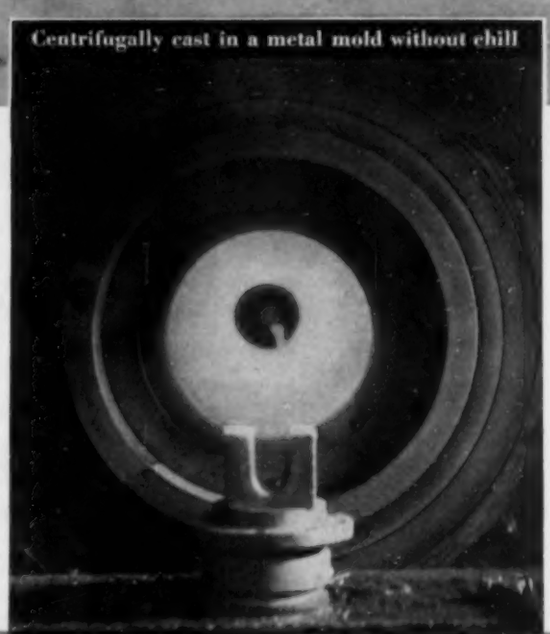
CHLORINATION, AMMONIA CHLORINE. Ammonia-Chlorine Treatment of Water in Pacific Northwest, C. E. Green. *Am. Water Works Assn.—Journal*, vol. 26, no. 7, July 1934, pp. 878–883. Review of experience of communities in Oregon, Washington, and Idaho. Bibliography.

WATER WORKS ENGINEERING

WATER PIPE, STORAGE. Die Rohrlagerhalle der staedt. Wasserversorgung Muenchen, O. Muy. *Bauingenieur*, vol. 15, nos. 13/14, Mar. 30, 1934, pp. 122–128. Design and construction of pipe warehouse, 23 m by 106 m long, for Munich water works; reinforced concrete columns spaced about 21 m apart; details of arched roof.

WATER TOWERS, CONCRETE. Neuere Wassertuerme in Eisenbeton, F. Zeillinger. *Beton u Eisen*, vol. 33, no. 7, Apr. 5, 1934, pp. 108–113. Structural details of 12-sided reinforced concrete water tower at Schifferstadt, Germany, 48.7 m high, having capacity of 1,000 cu m; details of square-shaped reinforced concrete water tower at Mutterstadt, Germany, 52.6 m high, having capacity of 530 cu m.

Recent installation of Super-de Lavaud Pipe at Chehalis, Washington.



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RECENT GRADUATE; Jun. Am. Soc. C.E.; single; B.S. in C.E., Carnegie Institute of Technology, 1934; 4 months experience as rodman and chainman with U. S. Coast and Geodetic Survey under the ERA. Desires position in any branch of civil engineering. Salary and location secondary. D-3731.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; B.S. in C.E., 1930; over 2½ years varied engineering experience, including highway design and construction, sewage disposal plant design, regional planning and mapping, drafting, surveying, bridge construction. Desires permanent position in any branch of civil engineering Willing to work. Location immaterial. Available immediately. C-7666.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Duke University, 1933. Majored in structural steel design and water supply; 1 month with U. S. Coast and Geodetic Survey; 3 months experience, water and sewage works; 3 years as inspector of telephone apparatus. Desires opportunity in any branch of civil engineering. Location immaterial. Available immediately. D-2683.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Rhode Island State College, 1934; 3 months as transitman and rodman; limited experience in concrete work. Desires opportunity in any branch of civil engineering for experience. Location immaterial. Available immediately. Salary secondary. D-3214.

TEACHING

CIVIL ENGINEER; M. Am. Soc. C.E.; 42; married; C.E. and M.S.E. degrees; 5 years teaching structural engineering and mechanics in leading engineering college; 16 years on difficult construction. Desires assistant or associate professorship, preferably in structural engineering or mechanics. B-9858.

PROFESSOR OF CIVIL ENGINEERING AND MATHEMATICS; Assoc. M. Am. Soc. C.E.; graduate licensed professional engineer; 42; married; 20 years varied engineering experience; several years experience teaching civil engineering and mathematics, including differential and integral calculus, mechanics, etc.; 5 years experience in the design of hydraulic structures; desires teaching position; location immaterial. C-6463.

STRUCTURAL ENGINEER; Assoc. M. Am. Soc. C.E.; C.E. degree, Polytechnic Institute in Zurich, Switzerland, 1919; majored in bridge engineering. Married; citizen; 2 years teaching experience. In the United States since 1922 with foremost engineering concerns as design engineer. Expert on indeterminate structures. Desires to teach statics, graphic statics, statically indeterminate structures, concrete and steel bridges, rigid frames. B-5176.

CIVIL ENGINEER; M. Am. Soc. C.E.; S.P.E.E.; Methodist Church; Masonic Lodge; degrees B.S., C.E., M.S.; major in structural engineering; minor in highway engineering; age 43; 6 years practical experience; 13 years successful teaching (one position), including 9 years as city engineer. Desires position teaching civil engineering or applied mechanics, or position with consulting engineer. D-302.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; married; B.S. in C.E., 1929; M.S. in C.E., 1933; 1¼ years structural detailer; experience in surveying, highway inspection, and lock construction; 3 years as instructor in structures and surveying at state university, including 4 summers in survey camp. Graduate work, structures, highways, hydraulics, and mechanics. Several publications. Desires position teaching structures, surveying, highways, hydraulics, mechanics. C-6066.

INSTRUCTOR; position wanted teaching mathematics and physics in either college or high school. Holds degree of B.S. in C.E. and is obtaining an M.A. in Education at New York University. State teaching license by June 1935. Christian; 24; will furnish references. Has done athletic coaching. D-3559.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; married; B.S. from Yale University; M.S. from Massachusetts Institute of Technology; 1½ years complete preliminary surveying experience, also some construction work. Over 1 year experience teaching mathematics in industrial high school in New York City. Desires teaching position in an engineering school. D-1050.

RECENT BOOKS

New books of interest to Civil Engineers, donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 75 of the Year Book for 1934. These notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

AMERICAN SOCIETY FOR TESTING MATERIALS, PROCEEDINGS OF THE 37TH ANNUAL MEETING, Vol. 34, 2 Vols. Philadelphia, American Society for Testing Materials, 1934. Illus., diagrs., charts, tables, 9 × 6 in., cloth, Vol. 1, 1325 pp.; Vol. 2, 943 pp., cloth, $6; half leather, $7 each.

The first part of this work contains the reports of committees, the "tentative standards," and the tentative revisions of standard specifications and tests. Among these reports are investigations of the effects of sulfur and phosphorus upon steel and of corrosion of non-ferrous metals in liquids and by galvanic and electrolytic action. The second part includes the papers and discussions presented at the 1934 meeting of the association upon metals, cements, ceramics, masonry, paints, rubber, and other topics. It also contains the Marburg lecture on "Water as an Engineering Material."

DER STRASSENBAU. (Sammlung Göschen 740.) By D. W. Geissler. Berlin and Leipzig, Walter de Gruyter & Co., 1934. 148 pp., illus., diagrs., charts, tables, 6 × 4 in., cloth, 1.62 rm.

A brief presentation of the elements of highway engineering and road construction, with special reference to German practice.

Great Britain. Scientific and Industrial Research Department. *Building Research Bulletin No. 11.* THE EFFECT OF BUILDING MATERIALS ON PLANT FILMS. By H. M. Llewellyn. Revised ed. London, His Majesty's Stationery Office (Obtainable from British Library of Information, New York, N.Y.), 1934. 8 pp., 10 × 6 in., paper, 3d; 10 cents.

The causes of various troubles experienced in painting plasters, cements, and other building materials are stated, and the proper precautions are indicated.

Eidgenössische Materialprüfungsanstalt an der E.T.H. in Zürich, Laboratoire Fédéral d'Essai des Matériaux Annexé à l'École Polytechnique Fédérale à Zürich, Bericht No. 79. EINFLUSS DES ZUSATZES VON "PLASTIMENT" AUF DIE BAUTECHNISCHEN EIGENSCHAFTEN DES BETONS.

"Plastiment" is a material added to portland cement that is intended to increase its strength, impermeability, and resistance to frost. The report gives the results of tests, which were favorable.

ELEMENTS OF SPECIFICATION WRITING, a Textbook for Students in Civil Engineering. By R. S. Kirby. 4 ed. New York, John Wiley and Sons, 1935. 168 pp., tables, 9 × 6 in., cloth, $2.

Professor Kirby has rewritten his well-known text on the art of writing specifications, retaining its original form, but incorporating considerable new material throughout and substituting recent references for older ones. A new chapter on "torts and the independent contractor" has been added, and the chapter on contracts has been materially expanded.

INTERNATIONAL ASSOCIATION FOR BRIDGE AND STRUCTURAL ENGINEERING, PUBLICATIONS, Vol. 2, 1933–1934. Published by the General Secretariat in Zurich; for sale by A. G. Gebr. Leeman & Co., Zurich, Switzerland, 495 pp., illus., diagrs., charts, tables, 10 × 7 in., paper, 34.80 Swiss francs.

This volume contains 29 papers dealing with various current problems of steel and reinforced concrete construction. They are written in French, English, or German, with summaries in all three languages.

INTRODUCTION TO STRUCTURAL THEORY AND DESIGN. By H. Sutherland and H. L. Bowman. 2 ed. New York, John Wiley and Sons, 1935. 318 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

An elementary presentation of the basic conceptions and principles of structural theory relating to trusses, rigid frames, and space frameworks. Numerous changes have been made in the new edition, including a more complete presentation of the methods of Prof. Hardy Cross. The section on moment distribution has been rewritten, and a section on column analogy added.

MISSISSIPPI VALLEY COMMITTEE OF THE PUBLIC WORKS ADMINISTRATION. Report submitted October 1, 1934, to Harold L. Ickes, Administrator of Federal Emergency Administration of Public Works. U. S. Government Printing Office, Washington, D.C., 1934. 234 pp., illus., maps, 12 × 9 in., cloth, $1.50.

This volume contains the complete text of the report upon the use and control of water within the Mississippi drainage basin, as submitted to the Public Works Administration on October 1, 1934. Policies regarding flood control, navigation, water supply, and power production, and the relations of water to the use of the land are discussed, many maps and charts being used. Plans are presented for a coordinated development of river regulation and use throughout the area.

PERCOLATION OF WATER THROUGH EARTH DAMS. By N. N. Pavlovsky; translated by Andreas Luksch, University of Iowa, Iowa City, Iowa; apply to translator. 212 pp., diagrs., charts, tables, 11 × 8 in., paper, $4.

A mathematical treatment of the problem of percolation, by the professor of hydraulics in the Leningrad Hydraulics Institute, is made available in mimeographed form, in a translation into English. The author derives a number of formulas of use in designing, and discusses a large number of special cases. The theoretical conclusions are compared with experimental results and found in agreement.

PORT OF SAN FRANCISCO, A STUDY OF TRAFFIC COMPETITION, 1921–1933. by H. F. Grady and R. M. Carr. Berkeley, Calif., University of California Press, 1934. 501 pp., tables, maps, 11 × 8 in., cardboard, $5.

The purpose of this study was to determine whether the port of San Francisco was losing trade and, if so, why and to what ports. The authors discuss the various factors that have influenced port development, both in San Francisco and in its competitors, and present a wealth of statistical and other data. As a study of the commerce of the whole Pacific slope, the book has a wider interest than that of the immediate problem.

ROAD AND RAIL IN FORTY COUNTRIES. By Dr. Paul Wohl and Prof. A. Albitreccia. London, Humphrey Milford; New York, Oxford University Press, 1935. 477 pp., tables 8 × 5 in., cloth, $6.

This volume gives a comparative survey of the conditions of road and rail transportation in the different countries. It avoids technical discussion and is addressed to the great proportion of the public which is affected by and interested in a well organized system of transportation.

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Looking down into the sheathed trench from the downstream side. The steel waling and crossbracing, which were carefully placed and largely welded, are shown.

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CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

CONCRETE ARCH, DESIGN. Ueber die Formgebung eingespannter Bogenbruecken, O. Hannelius. *Beton u Eisen*, vol. 33, no. 13, July 5, 1934, pp. 200–204. Mathematical theory of design of shape of fixed concrete-arch bridges; numerical examples.

CONCRETE ARCH, GERMANY. Die zweite feste Strassenbruecke ueber die Mosel bei Koblenz, genannt Adolf-Hitler-Bruecke, F. Dischinger. *Bautechnik*, vol. 12, nos. 12, 15, and 19, Mar. 23, 1934, pp. 130–134; Apr. 6, pp. 199–205; and May 4, pp. 246–248. Design and construction of concrete-arch highway bridge over Mosel River at Koblenz, Germany, comprising reinforced-concrete 3-hinged arches, 90 to 107 m in span; results of concrete tests for determination of correct mix; design of bridge approaches; construction of foundations and arch ribs. (To be continued.)

CONCRETE ARCH, IOWA. Unusual Skew Arch Designed with Stiffening Ribs and Thin Barrel. *Eng. News-Rec.*, vol. 113, no. 26, Dec. 27, 1934, p. 829. Description of reinforced-concrete skew-arch bridge of novel design, with 40-ft clear span, in Lee County, near Keokuk, Iowa; relatively thin slab is stiffened by ribs placed at right angles to channel.

MOVABLE. Old Swing Span Moved Upstream for Road Detour. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, pp. 785–787. Tide utilized to float and reseat 380 ft upstream 600-ton span, 323 ft long, over Fore River at Quincy, Mass.; old steelwork reinforced and braced for moving; temporary pile center pier designed to requirements of permanent structure.

PROGRESS REVIEW. Bridges and Tunnels of 1934. *Engineer*, vol. 159, no. 4121, Jan. 4, 1935, pp. 4–6, 2 supp. plates. Review of progress in Great Britain, Continental Europe, Asia, Africa, Canada, and the United States.

RAILROAD. Report of Special Committee on Economics of Bridges and Trestles. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 370, Oct. 1934, pp. 115–116. Comparative economic value of steel, treated timber, and concrete in bridges, trestles, and viaducts under various conditions of service, with due consideration of relative influence of durability of materials and obsolescence of property.

RAILROAD, VIBRATIONS. Mathematical Treatise on Vibrations in Railway Bridges, C. E. Inglis. *Mech. Eng.*, vol. 57, no. 1, Jan. 1935, pp. 58–59. Review by S. Timoshenko of book dealing with vibrations in bridges; it is stated that formulas used at present by bridge designers for determining impact factor have no scientific foundation, and engineers are paying more attention to dynamic stresses; three principal causes of dynamic effect of moving loads on bridge discussed.

WOODEN. Report of Committee 7-2—Bridge and Structural Timber. *Am. Wood-Preservers' Assn.—Proc.* mtg., Jan. 23–25, 1934, pp. 227–249, (discussion) 254–256. Service records of treated bridges and other structures; records of particular bridges and other structures that have given outstanding service; also of treated structures that have failed on account of improper methods of seasoning, treatment, or handling after treatment; effect of high residue in creosote.

WOODEN, STANDARDIZATION. Report of Committee VII—Wooden Bridges and Trestles. *Am. Ry. Eng. Assn.—Proc.*, vol. 35, mtg. Mar. 13 and 14, 1934, pp. 997–1009, (discussion) 1176–1179, 1 supp. plate. Simplification of grading rules and classification of timber; overhead wooden or combination wooden and steel highway bridges; standard wooden trestles for heavy loading; shear in checked beams, J. A. Newlin; best relationships between energy of hammer and weight or mass of pile for proper pile driving to include concrete piles; strengthening existing bridges.

BUILDINGS

HIGH BUILDINGS, DESIGN. Skyscraper of Future, R. Fleming. *Engineering*, vol. 139, no. 3600, Jan. 11, 1935, pp. 28–29. It is expected that the Century of Progress Exposition will give impetus to new forms of construction and utilization of new materials; future skyscraper, it is believed, will share in one way or another in these innovations.

MATERIALS. Influence de l'emploi des matériaux sur l'évolution des formes architectoniques, Hautecoeur. *Entreprise Française*, vol. 4, no. 40, Apr. 25, 1934, pp. 33–37. Brief study of influence of building materials on evolution in architectural design.

ROOF TRUSSES, REMOVAL. Traveler on New Low Roof Removes Old Arch Trusses. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, pp. 793–795. Riding on trusses of new train shed roof of La Salle Street Station, Chicago, steel traveler carries falsework to support arched roof trusses, 212-ft span being removed by traveler derricks.

WIND EFFECT. Wind-Tunnel Studies Reveal Pressure Distribution on Buildings—IV, W. W. Pagon. *Eng. News-Rec.*, vol. 113, no. 26, Dec. 27, 1934, pp. 814–919. Tests of square prisms as to turning and overturning moments, scale effect, and effect of eddies; internal pressures with various amounts of wall openings; constancy of drag coefficient diagrams of ideal flow around infinite square prism; pressure contours for wind at four different angles to front face.

CITY AND REGIONAL PLANNING

ZONING. Restriction of Rippon Development, L. W. Nott. *Surveyor*, vol. 86, no. 2230, Oct. 19, 1934, pp. 387–388. Zoning frontage land to arterial roads outside general development areas at low building density; service roads, deep building lines, imposition of road frontage charges on public highways; national lease over all agricultural land abutting on, and within limited distance of, sides of arterial roads; promoting group development on selected sites.

CONCRETE

CEMENT, SHRINKAGE. Réflexions sur une théorie générale du retrait des liants hydrauliques, Pigeaud. *Annales des Ponts et Chaussées* (Partie Technique), vol. 104, no. 4, July–Aug., 1934, pp. 50–77. Elaboration of rational theory, originally proposed by Freyssinet, accounting for shrinkage of hydraulic cement; capillary action as factor in shrinkage of cements.

COLUMNS. Eisenbetonstuetuetzen, Stahlstuetzen und einbetonierte Stahlstuetzen, A. Wickart *Schweizerische Bauzeitung*, vol. 104, no. 11, Sept. 15, 1934, pp. 115–119. Comparative study of engineering advantages and construction costs of 15 types of reinforced concrete and steel-concrete columns carrying loads of from 20 to 240 tons.

CONSTRUCTION, VIBRATION. Vibration as Applied in Placing Concrete, R. F. Legget. *Concrete & Constr. Eng.*, vol. 29, no. 6, June 1934, pp. 393–400. Effect of vibrating on strength of concrete and concrete-construction procedure; examples illustrating use of vibrators in Canadian practice.

CURING. Strength and Volume Change of Steam-Cured Portland Cement Mortar and Concrete, C. A. Menzel. *Am. Concrete Inst.—Journal*, vol. 6, no. 2, Nov.–Dec. 1934, pp. 125–148. Difference between steam-cured and moist-cured concrete; influence of temperature; duration of steaming period and size of silica particles; strength of steam-cured cement-silica mixtures made with 16 commercial cements; volume changes; leaching and efflorescence; rate of moisture loss and contraction; resistance to sulfate solutions, freezing, and thawing. Bibliography.

INDUSTRIAL PLANTS. Concrete in Factory Construction, L. F. Fairchild. *Am. Concrete Inst.—Journal*, vol. 6, no. 2, Nov.–Dec. 1934, pp. 149–164. Review of practice followed in construction and maintenance of concrete structures in several factories of Eastman Kodak Company, at Rochester, N.Y.; keeping steel away from surface; preventing rusting of steel sash; painting; expansion joint repairs; floor finish; pre-cast concrete trim.

LIGHT WEIGHT. Ueber Leichtbeton-Baustoff, A. Karsten. *Bautenschutz*, vol. 5, no. 4, Apr. 5, 1934, pp. 45–48. Properties of new light-weight concrete known as "Iporit"; this material, which was developed in Germany, can be cast in blocks of desired dimensions.

MIXING. Zielsichere Betonbildung, O. Stern. Vienna and Berlin, Julius Springer, 1934. 96 pp., figs., diagrs., charts, tables, supp. sheets. Results and applications of Austrian tests of methods of concrete proportioning and mixing; theory of potential distribution of grain sizes; cement and aggregate factors; distribution coefficients; forecasting of strength of concrete in flexural tension.

MIXING, TIME. Effect of Mixing Time on Quality of Concrete Produced in Large Mixers, W. A. Blanchette. *Pub. Roads*, vol. 15, no. 9, Nov. 1934, pp. 217–230. Investigation by U. S. Bureau of Public Roads of two concrete central-mixing plants to determine effect of length of mixing time on uniformity of distribution of ingredients and on strength of concrete as mixed in large-capacity mixers; length of mixing time, between 1 and 4 min, appears to have little effect on strength of concrete and on uniformity of distribution of ingredients.

STRUCTURES, MASONRY. Report of Committee VIII—Masonry. *Am. Ry. Eng. Assn.—Proc.*, vol. 35, mtg., Mar. 13 and 14, 1934, pp. 957–996, (discussion) 1180–1187. Specifications and principles of design of plain and reinforced concrete; progress in the manufacture of concrete; foundations; specifications for lining railway tunnels with concrete; pneumatically projected concrete; design of expansion joints involving masonry structures.

TESTING. Consistency Indicator for Ready-Mixed Concrete Plant, E. B. Rayburn, Jr. *Am. Concrete Inst.—Journal*, vol. 6, no. 2, Nov.–Dec. 1934, pp. 105–112. Apparatus devised by author for central mixing plant where mixing is done in 2-cu yd stationary mixer; advantages of mechanical control.

X-RAY ANALYSIS. Bestimmung des Mischungsverhaeltnisses von Beton durch Roentgenaufnahmen, W. Holtschmidt. *Bauingenieur*, vol. 15, no. 37/38, Sept. 14, 1934, pp. 363–366. Outline of X-ray method for determination of proportion of mix and nature of cement used in completed concrete structures.

DAMS

CONCRETE ARCH. Taylor Park Dam. Uncompahgre Project, Colorado. *U. S. Bur. Reclamation—Specifications*, no. 594, 99 pp., 40 supp. sheets. Schedules, specifications, and drawings of concrete arch dam at Taylor Park, Colo., having maximum height of 200 ft, length of 850 ft, including overflow spillway section 180 ft long; also specifications for alternative construction of earth and rock-fill dam of 168-ft maximum height, 600 ft long.

CONCRETE ARCH, GERMANY. Die Weisseritztalsperre an der Lehnmuehle, B. Gruhle. *Bauingenieur*, vol. 15, nos. 11/12, Mar. 16, 1934, pp. 99–106; see also English abstract in *Civ. Eng. (London)*, vol. 29, no. 335, May 1934, p. 154. Design and construction of straight concrete-gravity dam at Weisserits, on Lehnmuehle, having maximum height of 50 m and maximum length of 420 m, central part of which serves as spillway; observations on temperatures in body of dam during setting of mass concrete.

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RESERVOIRS, GREAT BRITAIN. Construction of Silent Valley Reservoir, Belfast Water Supply, G. McIldowie. *Instn. Civ. Engrs.—Min. Proc.*, vol. 239, no. 4947, pt. 1, 1934; 541 pp., 1 supp. plate; see also abstract in *Surveyor*, vol. 86, no. 2229, Oct. 12, 1934, p. 353. Completion of reservoir with capacity of 3,000,000,000 gal, formed by 1,500 ft of earth-fill embankment having maximum height of 88 ft; overflow consists of circular bellmouth 80 ft in diameter, passing in solid rock under embankment and discharging through stepped waste-channel into river.

WEIRS, BROAD CRESTED. Stroemungsvorgaenge an breitkronigen Wenrkoerpern und an Einlaufoauwerken, C. Keutrer. *Bauingenieur*, vol. 15, nos. 3, 7–38 and 39–40, Sept. 14, 1934, pp. 366–371; and Sept. 28, pp. 389–392. Critical review of approximate formulas of discharge from broad-crested weirs; results of recent tests made at hydraulic laboratory of Danzig Institute of Technology; determination of effect of ratio of width of crest to height of weir on discharge; effect of roughness of weir crest on energy balance.

FLOOD CONTROL

DISCHARGE. Hydraulics of Flood Movement in Rivers, H. A. Thomas. Pittsburgh, Carnegie Institute of Technology, 1934. 70 pp., diagrs., charts, tables. Pamphlet presents elements of hydraulic theory of unsteady flow in open channels needed in solution of problems pertaining to movement of flood waves in rivers and discusses various approximate methods used for handling them; useful to engineers interested in flood control. Eng. Soc. Lib., N.Y.

FLOW OF FLUIDS

HYDRODYNAMICS. On Disturbance of Steady Flow of Inviscid Liquid Between Parallel Planes, J. L. Synge. *Roy. Soc. Lond.—Philosophical Trans.*, vol. 234, no. A732, Dec. 31, 1934, pp. 43–78. Theoretical mathematical study including review of characteristic-value method; criticism of Rayleigh's condition for stability; expressions for velocity-components in terms of vorticity; finite disturbance; small disturbance; calculation of coefficients in power series.

FOUNDATIONS

BUILDINGS. Examen critique des fundations d'une construction située au voisinage d'un fleuve etc., Suquet. *Enterprise Française*, vol. 4, no. 38, Feb. 25, 1934, pp. 4–7. Critical examination of building foundations located in vicinity of river, high water level of which, in times of floods, is 3 m higher than level of basement.

FOOTINGS, STEPS. Ueber das Verhaeltnis der Stufenhoehe zur Stufenbreite bei Gruendungskoerpern in Stampfbeton, O. Colbergh. *Beton u Eisen*, vol. 33, no. 8, Apr. 20, 1934, pp. 128–131. Theoretical analysis and experimental data on determination of proper relation between rise and width of steps of concrete footings.

HYDRAULIC STRUCTURES, PRESSURE. Investigation of Pressures on Works on Sand Foundations—I, E. M. Taylor and H. L. Uppal. *Punjab Irrigation Research Inst.—Research Publ.*, vol. 2, no. 5, Feb. 1934, 14 pp., 8 supp. sheets. Colored solution method for determining, on same profile of model, pressures and path of flow of water under structure; for any fixed point under structure percentage drop in pressure is constant for all heads; path of flow from series of points near each other is constant and independent of head. Bibliography.

PILES, CONCRETE. Pile-Driving Formulas as Applied to Reinforced Concrete Pile, R. V. Allin. *Concrete & Constr. Eng.*, vol. 29, no. 6, June, 1934, pp. 357–361. Discussion of pile-driving formulas; extent to which some of principal old formulas meet changed conditions of modern, heavier, longer, and usually more stiffly-driven concrete pile.

WOOD PRESERVATION, RAILROAD. Report of Committee XVII—Wood Preservation. *Am. Ry. Eng. Assn.—Proc.*, vol. 35, mtg., Mar. 13 and 14, 1934, pp. 713–777, (discussion) 1162–1173, supp. plates. Proposed specification for creosote; service test records for treated ties; piling for marine construction; treatment of air-seasoned Douglas fir; destruction by termites and prevention; loss of preservative in ties in track due to use of oil-burning wood destroyers; protection of treated materials in field; service test records of structural timber, including piling.

HYDRAULIC ENGINEERING

MODELS, TIDAL. Tidal-Model Laboratory, M. P. O'Brien and B. D. Rindlaub. *Elec. West*, vol. 74, no. 1, Jan. 1935, pp. 22–23. Tidal model of mouth of Columbia River reproduces in concrete and to exact scale river bed 40 miles back from mouth; metal templets provide guides for shore configuration and also for cross sections of river bed at frequent intervals throughout its length; model, together with ingenious machine for reproducing river flow and tidal cycles, will enable accurate study of shifting of bar at mouth of river.

HYDROLOGY, METEROLOGY, AND SEISMOGRAPHY

EARTHQUAKES, SWITZERLAND. Bemerkungen zur Erdbenkarte der Schweiz, E. Wanner. *Schweizerische Bauzeitung*, vol. 103, no. 14, Apr. 7, 1934, pp. 159–160. Discussion of map showing distribution, frequency, and intensity of earthquakes in Switzerland.

OCEANOGRAPHY. Bodemgolven van groot formaat, geregistreerd met een echo-toestel, J. Van Veen. *Ingenieur*, vol. 49, no. 47, Nov. 23, 1934, pp. B213–B216. Large shoals registered by echo instruments in river and sea beds; relation between form of bed and stream flow; description of echo methods and apparatus used in investigations.

IRRIGATION

CANALS, UNITED STATES. Pumping Plant, Structures, and Canal Lining, Hyrum-Mendon, Wellsville, and Hyrum Feeder Canal, Hyrum Project, Utah. *U. S. Bur. Reclamation, Specifications*, no. 606, 41 pp., 19 supp. sheets. Schedule, specifications, and drawings.

SILT, ANALYSIS. Transmission Coefficient of Water in Natural Silts, V. I. Vaidhianathan and H. R. Luthra. *Punjab Irrigation Research Inst.—Research Publ.*, vol. 5, no. 2, Jan. 1934, 3 supp. sheets. Physical analysis of 13 canal bed silts for determination of their transmission coefficients, grain size distribution, and core space; bearing of these analyses on determination of rate of seepage through silt.

LAND RECLAMATION AND DRAINAGE

RAILROAD MAINTENANCE OF WAY. Report of Committee—I—Roadway. *Am. Ry. Eng. Assn.—Proc.*, vol. 35, mtg., Mar. 13 and 14, 1934, pp. 347–402, (discussion) 1104–1109. Roadbed drainage; practice of jacking culvert pipe through fills; bearing power and other physical properties of soils, including effect upon roadbed; protecting against drifting snow and opening snow blockades; protection against drifting sand.

MATERIALS TESTING

CONCRETE. Further Studies of Temperature Effects on Compressive Strength of Concrete, A. G. Timms and N. H. Withey. *Am. Concrete Inst.—Journal*, vol. 6, no. 2, Nov.–Dec., 1934; pp. 165–180. Effect of subsequent moist curing in developing potential strength of concrete; effect on compressive strength of storing concrete continuously in water at 33 and 50 F.

CONCRETE, IMPACT. Ein neues Verfahren zur Festigkeitspruefung des Betons im Bauwerk, K. Gaede. *Bauingenieur*, vol. 15, no. 35/36, Aug. 31, 1934, pp. 356–357. Method of testing finished concrete structures by ball impact, as in Brinell test, driven by special spring gun of Graven design, penetration of ball indicates approximate strength of concrete.

PAVEMENTS. Contribution a l'étude de la rugosité des chaussées, R. Boutteville. *Annales des Ponts et Chaussées* (Partie Technique), vol. 104, no. 4, July–Aug. 1934, pp. 78–106. Description of apparatus for testing of roughness of concrete and other types of pavements; results of tests; practical use of apparatus.

PORTS AND MARITIME STRUCTURES

BREAKWATERS, FAILURE. Destruction of Second Arm of Mustapha Breakwater at Algiers, B. Cunningham. *Engineering*, vol. 139, no. 3600, Jan. 11, 1935, pp. 27–28, supp. plate. Particulars of collapse of breakwater following storm in Mediterranean, Feb. 2 to 7, 1934; structure consisted of vertical wall of monolithic blocks set on prepared foundation of quarry refuse and small stone; comparison of dimensions of Mustapha Mole with those of modern breakwaters of similar type.

PANAMA CANAL ZONE. Panama Canal and Its Ports. U. S. Army Corps Engrs.—Port Series, no. 22, 1934, 99 pp., 21 supp. sheets. Port and harbor conditions; port customs and regulations; port services and charges; fuel and supplies; port and harbor facilities; communications; commerce.

RAILROAD STRUCTURES. Report of Committee XXV—Rivers and Harbors. *Am. Ry. Eng. Assn.—Proc.*, vol. 35, mtg., Mar. 13 and 14, 1934, pp. 677–697, (discussion) 1191–1196. Definition of terms; specifications for construction of river-bank protection; types of fender systems for protecting wharves; warehouse piers, coal and ore piers, car float piers, and others; clearances and bridges over navigable waterways. Bibliography.

SLIPWAYS. Marine Slipways, W. G. Glover. *Engineer*, vol. 159, no. 4122, Jan. 11, 1935, pp. 54–56. Adhering to what may be termed straight slipway and departing from rigid type of cradle, there are two outstanding methods of rendering equipment more flexible: use of telescopic drawbars operating between sections of cradle, which reduces first cost; and setting of haulage attachment in mid-cradle or in other defined position; examples of each type. Before Instn. Engrs. and Shipbldrs. in Scotland.

ROADS AND STREETS

EXPRESSWAYS. Elevated Public Highway along Hudson River Waterfront in Borough of Manhattan, R. J. Harrington. *Mun. Engrs. Journal*, vol. 20, third quarterly issue, 1934, pp. 116–127 (discussion), 127–130. Design and construction of expressway that will ultimately have total length of 15 miles and cost approximately $70,000,000.

INTERSECTIONS. Vorschlaege zur Ausbildung der Knotenpunkte der Reichsautobahnen, Speck and Hesse. *Bautechnik*, vol. 12, no. 37, Aug. 31, 1934, pp. 467–470. Proposed designs for complicated intersections on new German highways, including cloverleaf and similar intersection schemes.

MINES AND MINING, MISSOURI. Quarry and Plant of Reliance Rock Asphalt Corporation, E. H. Crabtree, Jr. and W. F. Netzeband. *Am. Inst. Min. & Met. Engrs.—Contrib.*, no. 77, mtg., Feb. 1935, 9 pp. Descriptions of deposits in Vernon County; bitumen content varies from trace to 14 per cent; overburden stripped; quarrying with jackhammer drills and dynamite; features of processing plant, with capacity of 400 tons per day of road material; in treatment, additional asphalt is added to hot crushed rock to bring total bitumen to required amount.

RAILROAD CROSSINGS. Report of Committee IX—Grade Crossing. *Am. Ry. Eng. Assn.—Proc.*, vol. 35, mtg., Mar. 13 and 14, 1934, pp. 561–577, (discussion) 1187–1190. Revision of manual; specifications for street crossings over railway tracks, both steam and electric; relative economy of different types of highway grade crossings; proper vertical curves on highways for grade separation projects; merits and economy in use of "stop and go" signal.

ROAD MATERIALS, CALICHE. Soil Tests Useful in Determining Quality of Caliche, H. S. Gillette. *Pub. Roads*, vol. 15, no. 10, Dec. 1934, pp. 237–242. Classifications and tests of caliches found in United States; chemical analyses and tests of cementing value; silica gel may be distinguishing feature of caliche performance.

ROADSIDE IMPROVEMENT. Roadside Planting in Texas a Regular Maintenance Task, A. P. Child. *Eng. News-Rec.*, vol. 113, no. 26, Dec. 27, 1934, p. 827. Landscaping, using native plants, planned to serve triple purpose of esthetics, recreation, and driving safety.

SLIPPERINESS. Provision and Maintenance of Non-Skid Surfaces to Carriageways, H. P. Tame. *Surveyor*, vol. 86, no. 2230, Oct. 19, 1934, p. 385. Reduction of skidding hazard on highway by surfacing with asphalt, concrete, granite sets, wood blocks, iron plates, etc.; maintenance of road surfaces; iron plates for arterial roads.

SOIL RESEARCH. Erdbaufragen der Reichsautobahnen, F. Koegler. *Bautechnik*, vol. 12, no. 37 and 41, Aug. 31, 1934, pp. 470–476, and Sept. 21, pp. 557–559. Solution of soil problems occurring in construction of Germany's automobile roads; design of subgrades, cuts, and fills in light of recent soil research; consolidation and waterproofing of embankments; tracing of alignment with respect to geological conditions.

SANITARY ENGINEERING

BATHS, WATER ANALYSIS. Vergleichende Untersuchungen des Wassers von offenen Badeanstalten in fliessenden und stehenden Gewaessern mit dem Beckenwasser der Hallenschwimmbaeder, H. Kluge and E. Zimmermann. *Gesundheits-Ingenieur*, vol. 57, no. 27 and 28, July 7, pp. 333–337, and July 14, pp. 343–346. Results of comparative chemical and bacteriological analyses of water of public baths in streams and ponds and of indoor swimming pools, indicating preferability of latter. Bibliography.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE. Effect of Aeration on Rate of Oxidation of Activated Sludge Mixtures, H. Heukelekian. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934, pp. 897–907. Results of experimental study by Department of Water and Sewage Research of New Brunswick, N.J.; evaluation of extent of oxidation; suspended solids reduction; bio-chemical oxygen demand reduction; bio-chemical oxygen demand to ratio of suspended solids; permanganate oxygen consumed of activated sludge mixtures; changes in percentage ash of suspended solids.

AERATION. Aeration of Sewage with and Without Activated Sludge, F. Schmiedt. *Surveyor*, vol. 86, no. 2229, Oct. 12, 1934, pp. 361–362. Purpose in injecting air into sewage; aeration requirements of different sewages; effect of sewage film; adsorption explaining many points of sewage purification. Abstract from *Technisches Gemeindeblatt*, Sept. 20, 1934.

CHEMICALS. Present Status of Chemicals in Sewage Treatment, J. H. Brendlen. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934; pp. 920–926, (discussion) 926–927. Review of practical application of chemicals to give satisfactory purification of sewage; production and cost of chlorine; flocculation; chemical costs. Before N.Y. State Sewage Works Assn.

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REFUSE DISPOSAL. Disposal of Garbage with Sewage Sludge, H. E. Babbitt. *Sewage Works Journal*, vol. 6, No. 6, Nov. 1934; pp. 1103–1108. Purpose of mixing garbage with sewage; factors involved; work at University of Illinois; previous work.

SEWAGE ANALYSIS. Investigation of Rapid Methods for Sludge Solids Estimation, J. I. Smith. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1, 1934, pp. 908–919. Comparative study of determination of sludge solids by centrifuge, specific-gravity, and aluminum-dish methods, showing superiority of last method.

SEWAGE FILTERS, TRICKLING. Effect of Bottom Ventilation on Purification by Experimental Trickling Filter, M. Levine and H. E. Goresline. *Ia. State College Agriculture & Mechanic Arts—Off. Publ.—Bul.*, no. 116, vol. 32, no. 45, Apr. 11, 1934; 16 pp. Observations on treating skimmed-milk solutions on small trickling filter, constructed to permit thorough natural bottom ventilation or complete elimination of bottom ventilation; effects of bottom ventilation.

SEWERS, CONCRETE, FAILURE. Failures in Concrete Sewer Pipe Arouse Los Angeles, G. B. Burtnett. *Brick & Clay Rec.*, vol. 85, no. 4, Oct. 1934, pp. 124–125, 128–130, 132 and 134. Investigations disclose disintegration in 745-mile sanitary sewer system; replacements with clay pipe costing considerably more money.

SEWERS, DESIGN. Einheitliche Bemessungsverfahren fuer Regen- und Mischwasserkanaele, Wirkung der Zugbewegung der Regen, E. Stecher. *Gesundheits-Ingenieur*, vol. 57, nos. 24 and 25, June 16, 1934, pp. 297–301, and June 23, pp. 309–315. Critical study of methods of computation of hydraulic capacity of combined and storm sewers, taking into account nature of drainage area and its run-off; original study of effect of direction of progress of rainstorm with reference to direction of flow of sewer system.

SLUDGE, ENGLAND. Digestion Rates of Mixed Sludges Shown by English Experiments. *Eng. News-Rec.*, vol. 113, no. 26, Dec. 27, 1934, pp. 828–829. Three-year research at Davyhulme Works of city of Manchester, England, on digestion characteristics of activated sludge alone and when mixed with primary tank sludge; aim of research was to determine minimum digestion period required to yield sludge that could be finally dealt with on land without fear of nuisance.

SLUDGE, FILTERS. Sludge Dewatering—Sand Filters and Vacuum Filters, F. W. Jones. *Sewage Works Journal*, vol. 6, no. 6, Nov. 1934, pp. 1109–1125, (discussion) 1126–1130. Source and quantity of sludge solids; types of sludge; quantity of digested sludge produced; methods of sludge disposal; sand filters; accomplishments of sand beds; drying bed area required; vacuum filters; accomplishments of vacuum filters; area required; cost of sludge dewatering; requisites for proper sludge disposal. Before Pa. Sewage Works Assn.

SLUDGE, ILLINOIS. Lipids of Sewage Sludge, O. J. Knechtges, W. H. Peterson and F. M. Strong. *Sewage Works Journal*, vol. 6, no. 6, Nov. 1934, pp. 1082–1093. Laboratory study of 11 samples of sludge from six sewage plants (Madison, Milwaukee, Chicago) with respect to amount and kind of lipids; four solvents were compared with respect to quantity of lipid extracted from sludges. Bibliography.

STREAM POLLUTION, NEW YORK CITY. Studies of Pollution of New York Harbor and Hudson River, E. B. Phelps. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934, pp. 998–1003 (discussion), 1004–1008. Review of quantitative data collected since 1909.

STRUCTURAL ENGINEERING

BEAMS, CONCRETE. Versuche an Balken mit Trogbewehrung, R. Saliger. *Beton u Eisen*, vol. 33, nos. 7 and 8, Apr. 5, 1934, pp. 104–107, and Apr. 20, pp. 123–128. Further tests, made at Vienna Institute of Technology, of strength of T-beams reinforced in part with perforated steel trough, which act as form during construction of beam; after construction plaster is put directly on trough reinforcement.

COLUMNS, CONCRETE ENCASED. Tragfaehigkeit von Stahlstuetzen mit Betonkern bei mittigem Kraftangriff, K. Memmler, G. Bieret, and G. Gruening. *Stahlbau (supp. to Bautechnik)*, vol. 7, nos. 7 and 8, Mar. 30, 1934, pp. 49–53, and Apr. 13, pp. 61–64. Report from German Materials Testing Bureau at Berlin-Dahlem on tests of 12 types of steel columns, 3.25 m long, built up of channel sections variously arranged and filled with concrete in most cases, showing increase in ultimate carrying capacity of columns practically equal to additive strengths of steel channels and concrete filling.

COLUMNS, STEEL, FOOTINGS. Ueber die Zulaessigkeit hoeherer Beanspruchungen des Betons unter den Fussplatten von Stahlstuetzen, J. Greiner. *Bautechnik*, vol. 12, no. 6, Feb. 9, 1934, pp. 67–68. Discussion of conditions permitting use of higher working stresses in concrete footings of steel columns; simplified design of column footings.

FLOORS, DESIGN. Difficultés recontrées dans l'étude du plancher haut du rez-de-chaussee, etc., Lebelle. *Entreprise Francaise*, vol. 4, no. 39, Mar. 25, 1934, pp. 13–17. Difficulties encountered in study of upper floors of building in which columns between stories do not coincide with those of ground floors.

GIRDERS, WELDED STEEL. Die Spannungsverteilung in Blechtraegern mit unterbrochenen Schweissnaehten, R. Kalina. *Stahlbau (supp. to Bautechnik)*, vol. 7, no. 5, Mar. 2, 1934, pp. 37–40. Theoretical study of distribution of stresses in plate girders with staggered welded joints, including case of concentrated load; numerical examples. Bibliography.

MONUMENTS, EARTHQUAKE RESISTANCE. Washington Monument, J. J. Creskoff. *Franklin Inst.—Journal*, vol. 218, no. 5, Nov. 1934, pp. 533–541. Theoretical examination leading to following conclusions: monument is safe on its present site; if shaft should be damaged during earthquake, failure will occur near 417-ft level; settlement may speed up during major earthquakes; method of making spalling invisible.

PIERS, EARTHQUAKE RESISTANT. Erdbebensichere Kaimauern in Japan, H. Wegner. *Bautechnik*, vol. 12, no. 12, Mar. 23, 1934, pp. 134–136. Structural features of recently constructed piers in Japanese ports, especially designed for earthquake resistance; analysis of earthquake stresses in marine piers.

ROOFS, WOODEN. Das Schalengewoelbe als Hoizkonstruktion, K. A. Pohl. *Bauingenieur*, vol. 15, no. 39/40, Sept. 28, 1934, pp. 381–384. Wooden barrel-arch construction, similar to Zeiss-Dywidag system of concrete barrel-arch, developed at Construction Research Institute of Moscow, U.S.S.R.; practical possibilities of design and results of experimental studies.

STATICALLY INDETERMINATE STRUCTURES, CONCRETE. Berechnung hochgradig statisch unbestimmter Rahmentragwerke, etc., S. Andruszewicz. *Forscherarbeiten auf dem Gebiete des Eisenbetons*, no. 44, 1935, 75 pp. Theoretical mathematical analysis of elasticity equations for design of highly indeterminate framed structures, with special reference to selection of redundant members.

STRUCTURAL STEEL. Relative Rigidity of Welded and Riveted Connections, C. R. Young and K. B. Jackson. *Can. Journal Research*, vol. 11, nos. 1 and 2, July 1934, pp. 62–100, and Aug., pp. 101–134. Experimental study made at University of Toronto; coefficients of restraint ascertained by determining end slope angles with special longitudinal extensometer attached to beam flanges tested as double cantilevers; load-slope relation produced by flexure, load-restraint diagrams; story drift due to connections; sources of deformation; ultimate stresses and factors of safety.

TUNNELS

RAILROAD, ITALY. Der Grosse Apennintunnel, Hacke. *Organ. fuer die Fortschritte des Eisenbahnwesens*, vol. 89, no. 6, Mar. 15, 1934, pp. 103–115. Critical review of practice and experience in construction of world's longest (18 km) double-track railroad tunnel in Appennine Mountains for new cut-off between Florence and Bologna; geological conditions; distribution of construction work and its progress; piping water and gas; ventilation and lighting; cost data.

WATER PIPE LINES

CONCRETE. Beton- und Eisenbetonleitungen—ihre Belastung und Pruefung, E. Marquardt. Berlin, Wilhelm Ernst & Sohn, 1934; 99 pp., figs., diagrs., charts, tables. Design, construction, and testing of underground concrete pipe lines; analysis of loads, with special reference to experimental work in United States by Marsten, Spangler, and others; testing of concrete pipe, including tests for resistance to low temperature, chemical corrosion, etc. Bibliography.

WATER RESOURCES

WATER LAW. Water Rights of Riparian Owners, L. T. Parker. *Water Works Eng.*, vol. 87, no. 15, July 25, 1934; pp. 821–823. Principles of riparian water right; right of private company to appropriate municipal property; liability for negligence by riparian owner; right of owner to improve property.

SWITZERLAND. Der natuerliche Wasserhaushalt im obern Aaregebiet, W. G. Spillmann. *Schweizerische Bauzeitung*, vol. 104, no. 3, July 21, 1934, pp. 25–28. Hydrological survey of watershed of upper Aare River, including data on elevation of portions of watershed, storage, evaporation, stream flow, etc.

UNDERGROUND. Underground Water Supplies. *Surveyor*, vol. 86, no. 2227, Sept. 28, 1934, pp. 305–306. Discussion at British Assn. Conference by W. S. Boulton, P. G. Boswell, and others on need for hydrogeological study, difficulty regarding publication of information, compulsory registration of wells, underground water as supplementary supply, and importance of deep borings

WATER TREATMENT

ALGAE CONTROL. Copper Sulfate as Algicide. *Water Works Eng.*, vol. 87, no. 15, July 25, 1934; pp. 824–826. Discussion by water-works superintendents of practice of use of copper sulfate as algicide; dosage and frequency of treatment with copper sulfate.

ANALYSIS, CHLORIDE DETERMINATION. Colorimetric Determination of Small Quantities of Chlorides in Waters, H. B. Riffenburg. *Indus. & Eng. Chem.* (Analytical Edition), vol. 7, no. 1, Jan. 1935, p. 14. Brief commentary and description of method and procedure. Bibliography.

ANALYSIS, FLUORINE DETERMINATION. Determination of Fluorine in Drinking Water, H. V. Smith. *Indus. & Eng. Chem.* (Analytical Edition), vol. 7, no. 1, Jan. 1935, pp. 23–25. Comparison of several methods and establishment of toxic concentration by these methods.

CHLORINATION. Germicidal Activity of Available Chlorine as Measured by Ortho-Tolidine and Iodometric Tests for Chlorine, W. L. Mallmann. *Mich. Eng. Experiment Station—Bul.*, no. 59, Sept. 1934, 15 pp., Price 25 cents. Comparison of iodometric and ortho-tolidine tests in presence of 0.2 per cent lactose or of 0.1 per cent agar-agar; influence of charcoal on iodometric and ortho-tolidine tests for chlorine before and after centrifugation to precipitate charcoal. Bibliography.

DUTCH EAST INDIES. De door het Proefstation voor Waterzuivering "Manggarai" in 1933 verrichte onderzoekingen, N. D. R. Schaafsma. *Ingenieur in Nederlandsch-Indie*, vol. 1, no. 3, Mar. 1934 (Waterbouwkunde), pp. 29–46, 1 supp. sheet. Review of research in 1933 by Nanggarai water treatment experiment station in Dutch East Indies, with special reference to water bacteriology, water filtration, and examination of water pipe lines.

HISTORY. Sketch of History of Water Treatment, M. N. Baker. *Am. Water Works Assn.—Journal*, vol. 26, no. 7, July 1934, pp. 902–938. Review of practice since Roman Empire; water treatment in modern times; beginnings of filtration in America; disinfection; multiple filtration and other novelties; growth of filtration in the period from 1870–1930; sedimentation without and with coagulation; ozone and ultra-violet ray treatment; deferrization and demanganization; goiter and typhoid control; Sedgwick's water-refining age. Bibliography.

OPERATION OF PLANTS. Chart for Quick Calibration of Dry Feed Machines at Plant, E. C. Handorf. *Water Works Eng.*, vol. 87, no. 14, July 11, 1934, pp. 775–776. Construction of alignment chart for simplifying determination of grains-per-gallon in operation of dry feed machines.

OZONE. Water Purification by Ozone, T. Rich. *Engineering*, vol. 139, no. 3599, Jan. 4, 1934, pp. 9–11, and 14. Description of Otto generator of type used for such duty as water sterilization, wood conditioning, and bleaching, made up of three high-tension electrodes contained in water-cooled box; illustrations.

SWIMMING POOLS. Die Wasserre inigungsanlage des Dolderbades, H. Bauer. *Schweizerische Bauzeitung*, vol. 104, no. 12, Sept. 22, 1934; pp. 133–135. Description of filtering and chlorinating equipment of Dolder swimming pool, Zurich, Switzerland.

WATER WORKS ENGINEERING

CALGARY, ALBERTA. Calgary's New Water Works System, W. Gore. *Am. Water Works Assn.—Journal*, vol. 26, no. 8, Aug. 1934, pp. 977–1014. Design, construction, and operation of new water works system serving population of 85,000 with daily per capita consumption of over 300 gal.; system comprising Glenmore Reservoir with earth and concrete dam of 60-ft maximum height, pumping station, and filtration plant of 27-mgd capacity; total cost about $4,000,000.

FINANCING. Finance and Accounting Division Discusses Taxation. *Water Works Eng.*, vol. 87, nos. 15 and 16, July 25, 1934, pp. 827–830 and 833; and Aug. 8, pp. 878–879. Proceedings of 1934 annual meeting of American Water Works Association, including abstracts of papers: Changes in Federal Tax Laws Affecting Water Companies, L. D. Blum; Taxation of Municipal Water Works, A. G. Kamplain; Property Record for Investment in Fixed Capital, F. C. Hamilton; Work Incentives—with Particular Reference to Their Application to Municipal Water Works, H. F. Smith; Financial History of Water Department of City of New York, J. Goodman; Uniform Classification of Accounts Suitable for Municipal and Private Plants, E. V. Williamson; Federal Securities Act in Relation to Financing of Water Companies, B. H. Evans; Effective Publicity as Means of Eliminating Water Waste, H. L. Meites.

OPERATION. Water Rates for Temporary Service. *Water Works Eng.*, vol. 87, no. 14, July 11, 1934, pp. 777–779. Practical discussion by water-works superintendents of methods and rates of charging for temporary services, such as building work, circuses, etc.

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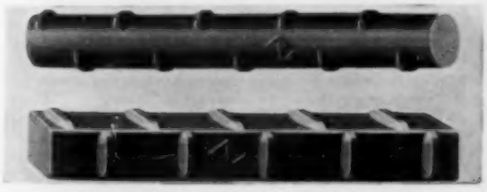

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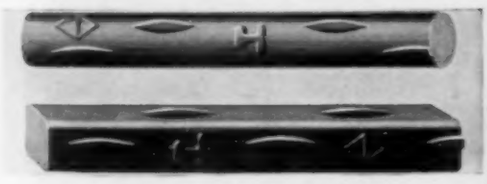

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CIVIL ENGINEER; M. Am. Soc. C.E.; 49; 27 years experience, specializing in investigation, design, inspection, consultation, and construction of large hydro-electric projects in this country and abroad. Desires responsible position with engineering or contracting organization, designing or constructing; can handle any phase of this work, including plant layout, cofferdams, and installation of machinery. B-70.

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CIVIL ENGINEER; Jun. Am. Soc. C.E.; 29; married; B.S. in C.E., Manhattan College, 1927; 2 years experience drafting on subway construction; 4 years experience as transitman and chief of party; 1 year experience in highway and bridge construction; desires position in any branch of civil engineering. Available immediately. D-3617.

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CIVIL AND MECHANICAL ENGINEER; M. Am. Soc. C.E.; member A.S.M.E.; 44; married; graduate mechanical engineer; 24 years in field and office on harbor, channel, jetty, bulkhead, and dock construction. Operation, design, and construction of all sizes of dredges and marine contracting equipment. Investigations and cost estimates. Available on short notice. D-578.

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CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E. (cum laude), New York University, 1934; 5 months experience in mechanical drafting. Desires position in any field of civil engineering, preferably structural or highway, or on engineering periodical. Location and salary secondary. D-3775.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 28; single; 6 months municipal engineering; 3 months drafting; 2 years as structural research engineer with large company; 3 months surveying as transitman, chief of party. Good draftsman and letterer. Excellent references. Flair for detail. Available now. New York or vicinity preferred, but can go anywhere. C-5768.

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CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single; B.S. in C.E., Newark College of Engineering; 1½ years as draftsman; limited experience in surveying. Desires opportunity in any branch of civil engineering. Available immediately. Location immaterial. D-3792.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., Duke University, 1933. Majored structural steel design and water supply; 1 month with U. S. Coast and Geodetic Survey; 3 months experience, water and sewage works; 3 years as inspector of telephone apparatus. Desires opportunity in any branch of civil engineering. Location immaterial. Available immediately. D-2683.

GRADUATE CIVIL ENGINEER; 26; single; Jun. Am. Soc. C.E.; B.S. in C.E., Iowa State College, 1934; registered professional engineer, Minnesota and Iowa; 4 years experience as assistant to county engineer. Chief interests: highways, geodesy, municipal, and structures. Type of work and salary secondary. Available immediately. Location in Hawaii or the Philippines desired. D-3689.

CIVIL ENGINEER; Junior Am. Soc. C.E.; 21; single; B.S. in C.E., University of Texas, 1934; desires a position in any field of engineering; some experience in sanitary and highway engineering; good scholastic record. Salary and location open. Available immediately. D-3831.

TEACHING

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; married; B.S., C.E., 1929; M.S., C.E., 1933; 1¼ years structural detailer; experience in surveying, highway inspection, and lock construction; 5 years instructor, structures and surveying, at state university, including 4 summers in survey camp. Graduate work in structures, highways, hydraulics, and mechanics. Several publications Desires position teaching structures, surveying, highways, hydraulics, mechanics. C-6966.

STRUCTURAL ENGINEER; Assoc. M. Am. Soc. C.E.; C.E. degree from Polytechnic Institute in Zurich, Switzerland, in 1919; majored in bridge engineering; married; citizen; 2 years teaching experience. In the United States since 1922 with foremost engineering concerns as design engineer. Expert on indeterminate structures. Desires to teach statics, graphic statics, statically indeterminate structures, concrete and steel bridges, and rigid frames. B-5176.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 30; single; B.S. in civil engineering, Pennsylvania State College; majored in city planning and highway engineering; 9 years experience in general construction; experienced instructor, author; public speaker, and executive; desires position as instructor, research or executive, in civil engineering. D-2776.

RECENT BOOKS

New books of interest to Civil Engineers, donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. These notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

AIR CONDITIONING, FUNDAMENTAL PRINCIPLES, PRACTICAL INSTALLATIONS AND OZONE FACTS. By E. W. Riesbeck. Chicago, Goodheart-Willcox Company, Inc., 1934. 352 pp., illus., diagrs., charts, tables, 8 × 5 in., leather, $3.50.

The first section of this book discusses the installation and operation of air conditioning equipment in non-technical language and from a practical point of view. The second section discusses in similar fashion the use of ozone for sterilizing air and water. The book is designed to assist heating and plumbing contractors and others interested in air conditioning.

PUBLIC UTILITY VALUATION FOR PURPOSES OF RATE CONTROL. By J. Bauer and N. Gold. New York, Macmillan Co., 1934. 477 pp., 9 × 6 in., cloth, $3.50.

The aim of this book is to present a comprehensive discussion of utility valuation. The economic and legal fundamentals, the practical methods pursued and the procedural aspects of valuation are discussed, with special regard to objectives, policy, and the administrative requirements of public control. The present system of rate regulation is examined critically, and suggestions for revision offered. The authors are well-known specialists in the field, and the book is an important addition to the literature.

STRENGTH OF MATERIALS. 4 ed. By J. E. Boyd. New York and London, McGraw-Hill Book Co., 1935. 548 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.75.

This text is intended to give the student a grasp of the physical and mathematical ideas underlying the mechanics of materials, together with enough of the experimental facts and simple applications to prepare him for subsequent technical subjects as given in books on machine design, reinforced concrete, or stresses in structures. This edition has been revised thoroughly.

WATER SUPPLY AND TREATMENT. By C. P. Hoover. Bulletin 211. Washington, D.C., National Lime Association, 1934. 143 pp., figs., diagrs., charts, tables.

This book outlines sources of water supply and methods of purification, filtration, and disinfection. It describes various processes of water softening and discusses the treatment of boiler feed-water and various methods of water analysis.

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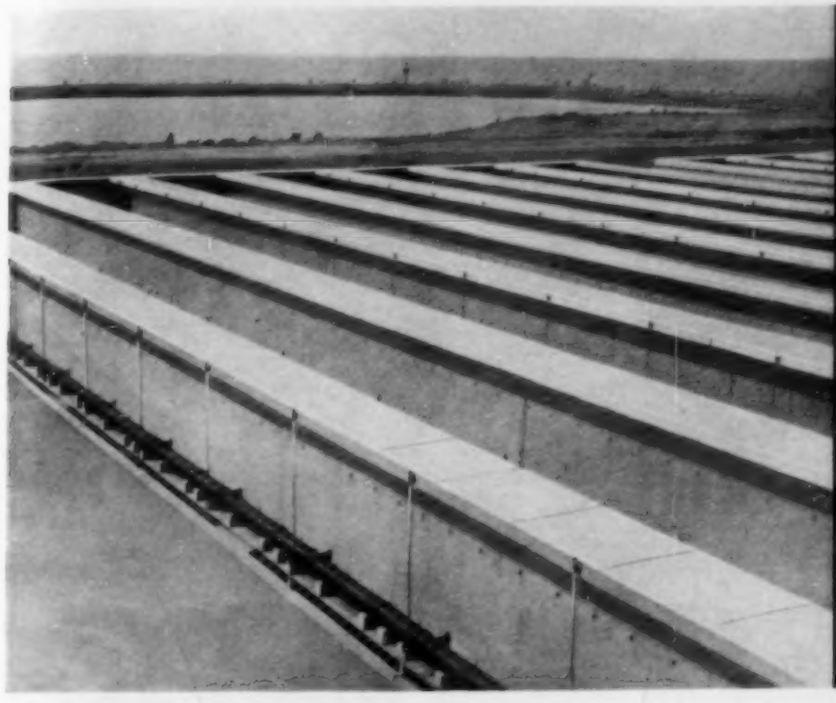

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BRIDGES

STEEL ARCH, SWEDEN. Eine neue Strassenbruecke ueber den Maelarsee in Stockholm, E. Nilsson. *Bautechnik*, vol. 12, no. 40, Sept. 18, 1934, pp. 507–521. Design and construction of steel-arch highway bridge over the Maelarsee Canal at Stockholm, Sweden, having total length of 601.5 m, and consisting principally of two 2-hinged arches, 168 and 204 m in span; details of abutments and floors; use of welding equipment, hydraulic riveting machines, etc.

STEEL TRUSS, HUNGARY. Bau einer neuen Donau-Strassenbruecke in Budapest, B. Algyay-Hubert. *Bautechnik*, vol. 12, no. 34, Aug. 10, 1934, pp. 435–438. Design and construction of new highway bridge over the Danube River in Budapest, consisting principally of three steel-truss spans, 112 to 154 m long, and having total length of about 515 m.

TRESTLE. Four Long Trestles Cross Bonnet Carré Spillway, E. E. R. Tratman. *Eng. News-Rec.*, vol. 114, no. 1, Jan. 3, 1935, pp. 12–17. Design and construction of three railway trestles, of timber, steel and concrete, and of highway trestle, of concrete, intended to carry traffic across Mississippi River flood-relief channel, which is from 1½ to 2½ miles wide; concrete fire walls and piers; details of steel spans built to serve as fire-stops; piers and walls of reinforced concrete; pile handling.

WOODEN. Timber Arch of 180-Ft Span Uses Metal Ring Connectors. *Eng. News-Rec.*, vol. 114, no. 5, Jan. 31, 1935, pp. 147–149. California highway bridge across Dolan Creek, consisting of 180-ft timber arch, four 38-ft timber girder spans, and thirteen 19-ft stringer spans; three-hinged timber arch built with timber for all stress members by use of metal connector rings; framing yard work; erecting arch ribs.

BUILDINGS

EARTHQUAKE EFFECT. Zur Theorie der Erdbebensicherheit von Bauwerken, K. Sawriew. *Bauingenieur*, vol. 15, nos. 27/28, July 6, 1934, pp. 283–285. Critical review of Omori and Mononobe theories of anti-earthquake design showing that values of forces of inertia given by these theories are only 50 per cent of what may actually be expected from correct theoretical considerations.

WIND STRESSES. Tests of Steel Model of 55-Story Wind Bent, C. T. Morris, G. E. Large, and S. T. Carpenter. *Ohio State Univ.—Eng. Experiment Station—Progress Report*, Nov. 1934, 30 pp. Progress report on tests of model representing lower 13 stories of 3-panel wind bent designed by Spurr method and reduced to 1/24 size; stresses, deflection data, and joint rotations observed under design wind loading.

CITY AND REGIONAL PLANNING

HOUSING, UNITED STATES. Planning American Standards for Low-Rent Housing, A. Fellheimer. *Am. Architect*, vol. 146, no. 2630, Feb. 1935, pp. 12–28. Review of results of research, objectives, and standards; owner's standpoint; assembly of unit plans; plan units for low-rent housing.

MISSISSIPPI VALLEY. Broad Development Plan Proposed by Mississippi Valley Committee. *Eng. News-Rec.*, vol. 114, no. 1, Jan. 3, 1935, pp. 19–21. Review of Mississippi Valley Committee report outlining 20-year development plan for flood control, water supply, power, and irrigation; cost of possible 20-year program.

RECLAMATION OF LAND. Engineering Phases of Land-Use Planning. *Agric. Eng.*, vol. 15, no. 9, Sept. 1934, pp. 315–323. Symposium on mechanization, land reclamation; structures, electrification, and management by S. H. McCrory, L. J. Fletcher, H. Sibley, E. R. Jones, R. H. Driftmier, E. A. White, D. H. Doane, and C. H. Everett. Before Am. Soc. Agric. Engrs.

SLUMS. What Do Slums Cost? W. S. Parker. *Arch. Rec.*, vol. 77, no. 2, Feb. 1935, pp. 75–77. Review of data gathered in Boston survey.

CIVIL ENGINEERING

UNITED STATES. 1934 Progress and Outlook 1935. *Eng. News-Rec.*, vol. 114, no. 6, Feb. 7, 1935, pp. 183–230. Annual symposium on the progress of civil engineering in the United States, consisting of editorial notes and signed articles: Economic and Business Changes, D. Dillman; Recovery Measured by Men at Work, I. Lubin; Construction Facts and Outlook; Drought, Weather, and Streamflow, J. C. Hoyt; Progress Made on Large Engineering Projects; Have Codes Aided Recovery? A. J. Hettinger, Jr.; First Year of Code, S. F. Voorhees; Contracting Under Code, A. E. Horst; Subcontractors' Code Problems, G. P. Marshall; Engineers and Code System, C. Proctor; Toward Better Labor Relations, S. W. Jones; Resources Study Begun, C. W. Eliot 2d; Public Works and Recovery, I. D. Foos; Construction in Relief Service, J. Baker; Obstacles to Housing Progress, A. C. Holden.

CONCRETE

CONSTRUCTION, COLD WEATHER. Zementputz bei Frost, W. Wichmann. *Zement*, vol. 23, no. 49, Dec. 6, 1934, pp. 723–727. Cement stucco in frost; account of recent tests in Soviet Union, conducted by Kirejenko at Kiev Institute, on methods of proportioning for cement stucco for purpose of increasing mortar strength during freezing of mortar.

CONSTRUCTION, DAMS. Kuehlung von Beton, Von Emblik. *Zeit fuer die gesamte Kaelte-Industrie*, vol. 41, no. 12, Dec. 1934, pp. 212–214. Cooling of concrete; new application of refrigeration, with special reference to its use in construction at Boulder Dam.

CONSTRUCTION, WOOD REINFORCEMENT. Composite Timber-Concrete Construction for Buildings and other Structures, J. F. Seiler. *Am. Wood-Preservers' Assn.—Proc.* mtg., Jan. 23–25, 1934, pp. 263–278, (discussion) 278–279 and 280–281. Recent developments in composite timber-concrete construction; possibilities that it offers for extending field of application of treated wood in various structures and for increasing economy and efficiency of its use.

PILES, CONCRETE, ENCASEMENT. Bituminized Concrete Casing for Piles in Sea Water. *Eng. News-Rec.*, vol. 114, no. 4, Jan. 24, 1935, pp. 121–124. Protection of pre-cast concrete piles for trestle across swift tidal waters of Bellamy River in New Hampshire by encasing them, for height of tide range, with pre-cast asphalt-impregnated concrete plates embedded in pile; casting armored piles; sling arrangement for lifting and up-ending 105-ft, reinforced concrete piles, 20 in. square.

RESEARCH. Ueber einige Aufgaben der Eisenbetonforschung aus aelterer und neuerer Zeit., O. Graf. *Beton u Eisen*, vol. 33, no. 11, June 5, 1934, pp. 165–173. Review of old and new research in concrete with particular reference to shrinkage, creep, assignment of working stresses for reinforcement and concrete, and measurement of momentary distortion of concrete bases of turbine foundations.

DAMS

BOULDER DAM PROJECT. Progress of Construction at Boulder Dam, W. R. Nelson. *Reclamation Era*, vol. 25, no. 1, Jan. 1935, pp. 8–11. Review of construction progress since May 1933; founding of Boulder City; Colorado River diverted; construction of spillways; tunnel linings; fabricating outlet pipes.

BOULDER DAM PROJECT, SPILLWAYS. Boulder Dam Spillways, W. R. Nelson. *Reclamation Era*, vol. 25, no. 2, Feb. 1935, pp. 30–32. Design and construction of spillways having total capacity of 400,000 cu ft per sec, including inclined tunnel spillways with drop of about 570 ft; concrete lining of channels; installation of drum gates.

CONCRETE ARCH, HEAT FLOW. Flow of Heat in Dams, R. E. Glover. *Am. Concrete Inst.—Journal*, vol. 6, no. 2, Nov.–Dec. 1934, pp. 113–124. Problems of heat flow encountered in design of slender arched dams; mathematical theory of heat conductions; cooling of flat slab; time lag of mean temperature of concrete behind external variation; measurement of diffusion constant.

CONCRETE GRAVITY, CALIFORNIA. Concrete Gravity Dam for Faulted Mountainous Area, S. B. Morris and C. E. Pearce. *Eng. News-Rec.*, vol. 113, no. 26, Dec. 27, 1934, pp. 823–827. Description of concrete-gravity Morris Dam, of 328-ft maximum height, for water supply of Pasadena, Calif., providing for earthquake resistance, numerous outlets for stream regulation and spillway in difficult location; geology of site; treatment over fault; spillway discharging 80,000 cu ft per sec, or twice maximum flow, consists of three automatic, floating-drum-type gates, hinged downstream.

EARTH, AUSTRALIA. Construction of Silvan Dam, Melbourne Water-Supply, A. E. Kelso. *Instn. Civ. Engrs.—Min. Proc.*, vol. 239, no. 4824, pt. 1, 1934, 46 pp., 1 supp. sheet. Design and construction of rolled earth-fill dam, 134 ft in maximum height, 2,114 ft long, having reinforced concrete corewall, 4 ft thick, reaching maximum depth of 145 ft below natural surface.

EARTH, UTAH. Moon Lake Dam. Moon Lake Project, Utah. *U. S. Bur. Reclamation—Specifications*, no. 605, 60 pp., 19 supp. sheets. Schedule, specifications, and drawings for construction of earth and rock-fill dam, 90 ft maximum height forming part of Moon Lake Project, Utah, including tunnel spillway 600 ft long.

RESERVOIRS, IRELAND. Construction of Silent Valley Reservoir, Belfast Water Supply, G. McIldowie. *Engineering*, vol. 139, no. 3600, Jan. 11, 1935, pp. 33–34. Method embodied provision of additional shafts to hasten dewatering operation, special form of trench construction, and modification of form of embankment; embankment is 1,500 ft long and has maximum height of 88 ft above bed of Kilkeel River; overflow consists of circular bellmouth in reservoir 80 ft in diameter at top water. Before Instn. Civ. Engrs.

FLOOD CONTROL

CALIFORNIA. San Gabriel River Flood Control. *Eng. News-Rec.*, vol. 114, no. 4, Jan. 24, 1935, pp. 113–117. Review of decade of planning and construction work designed to control and conserve floods of San Gabriel River in southern California since establishment of Los Angeles County Flood Control District in 1924; construction of San Gabriel Dam No. 1; pay schedule and quantity estimates. Bibliography.

CHINA. Radical Improvement Scheme for Yung Ting Ho, H. Shih-ta and L. Shu-t'ien. *Assn. Chinese & Am. Engrs.—Journal*, vol. 15, nos. 2 and 3, Mar. 1934, pp. 22–34, and May, pp. 12–25, 1 supp. sheet. Radical improvement scheme for regulation of river in North China having drainage area of 47,000 sq km; Kuan Ting detention basin; Tai Tze Mu detention basin; reconstruction of Lu Kou Chiao weir; repairs to Chin Men Cha; regulation of main channel; contraction of main channel; improvement of outlet; check dams; silt depositing districts; benefits to be derived. (In English.)

FOUNDATIONS

BRIDGE PIERS, CONSTRUCTION. Die Zwischempfeiler der Kanalbruecke des Schiffshebewerks Niederfinow, Detig. *Bautechnik*, vol. 12, no. 40, Sept. 18, 1934, pp. 522–535. Design and construction of large steel and concrete piers, sunk by pneumatic caisson method, for so-called "canal bridge" at Niederfinow boat lift, Germany, where extremely difficult foundation conditions were encountered; testing of concrete aggregates; concrete mixing and testing in fields.

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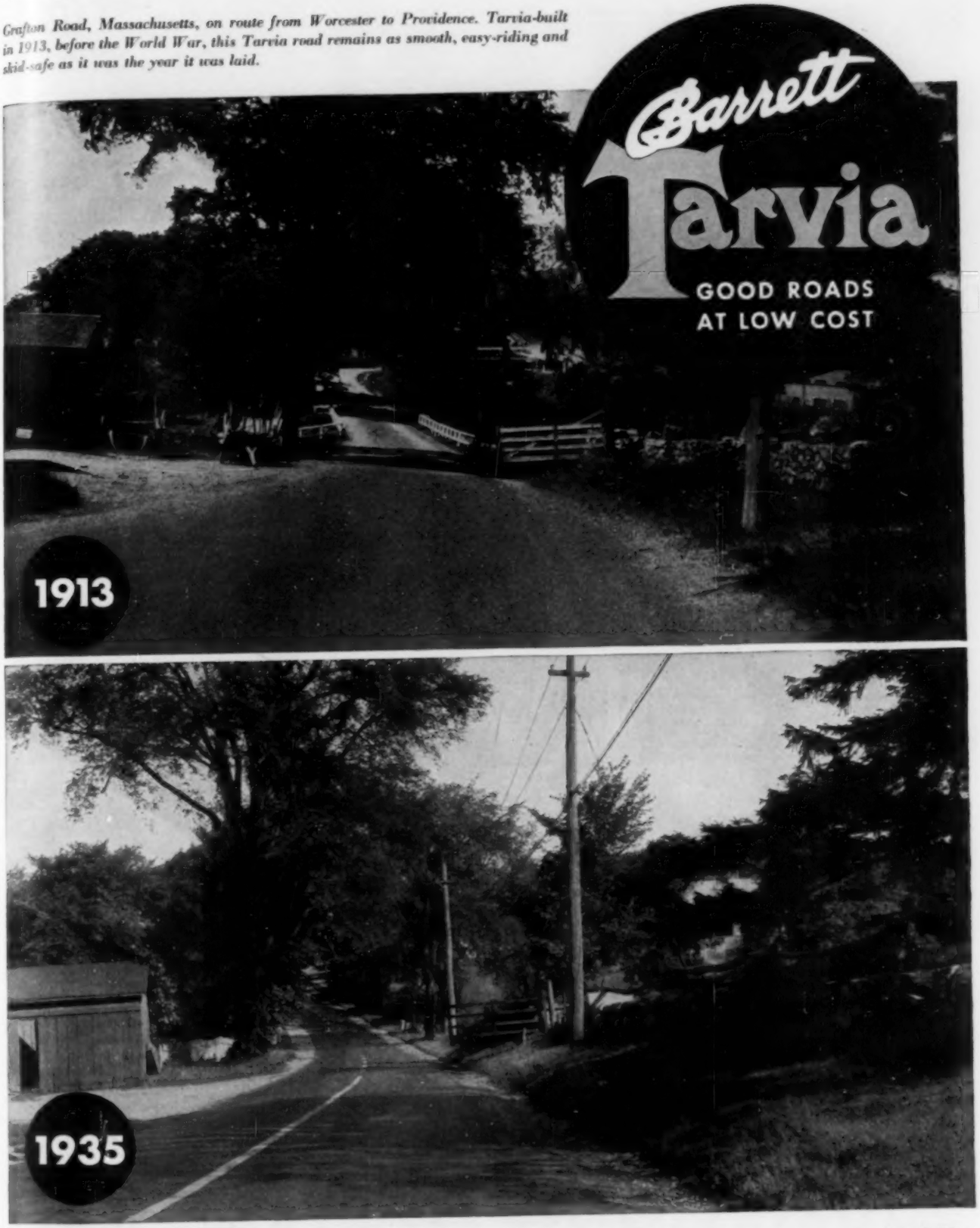

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DESIGN. Druckverteilung unter starren und elastischen Lastflaechen verschiedener Groesse bei verschiedenartiger Belastung im Sand und Lehm, H. Press. *Bautechnik*, vol. 12, no. 43, Oct. 5, 1934, pp. 569–571. Experimental study of distribution of pressures in sand and clay layers under rigid or elastic bearing plates of various dimensions, variously loaded.

PILES, STEEL. H-Piling Finds Use in Piers, Bridges, and Fish Traps. *Steel*, vol. 95, no. 20, Nov. 12, 1934, pp. 33–34. Within last seven or eight years use of H-type structural-steel piles has spread to include many varied types of construction; largest uses so far developed have been in bridges, wharves, or piers, but they have also found use in building and other types of construction; details of various applications.

PILES, WOODEN. Experiences in Use of Treated Material in Construction Work Including Foundations, R. J. Cummins. *Am. Wood-Preservers' Assn.—Proc.* mtg., Jan. 23–25, 1934, pp. 206–210, (discussion) 210–211. Example showing instance where false economy practiced in placing of foundations resulted subsequently in great expense to owners; theories advanced as to cause of failure.

TESTING. Die Ermittlung der fuer das Bauwesen wichtigsten Eigenschaften des Bodens durch erzwungene Schwingungen, A. Hertwig, G. Frueh and H. Lorenz. Veroeffentlichungen des Instituts der Deutschen Forschungsgesellschaft fuer Boden-Mechanik (Degebo). Berlin, Julius Springer, 1933, no. 1, 44 pp., figs, diagrs., charts, tables. Engineering tests of foundation soils by method of damped vibrations; theory of apparatus and mathematical analysis of settlement curves; precision of theory; results of 231 tests. Bibliography.

HYDRAULIC ENGINEERING

CONCRETE CONSTRUCTION. Water-Retaining Concrete Structure. *Engineering*, vol. 139, no. 3605, Feb. 15, 1935, pp. 181–182. Review of report drawn up by Institution of Structural Engineers, dealing with structures that depend on concrete for their water-retaining properties and apply to such structures only.

LABORATORIES, UNITED STATES. Current Hydraulic Laboratory Research in United States. *U. S. Nat. Bur. Standards—Bul.*, no. 111–1, Jan. 1, 1935, 83 pp. Information on current and completed projects in hydraulic laboratories in the United States, also research publications, translations from foreign languages, and bibliography.

MODELS, DISTORTION. Sur l'emploi d'échelles verticales et horizontales différentes dans les études sur modeles réduits en hydraulique, C. Camichel, E. Fischer and L. Escande. *Houille Blanche*, vol. 33, nos. 211/212, July/Aug. 1934, pp. 99–100. Critical examination of principle of distorted hydraulic models having different horizontal and vertical scales; tests show that such distortion is not always permissible.

SILT, TRANSPORTATION. Sulla forza di trascinamento delle correnti liquide, E. Indri. *Energia Elettrica*, vol. 11, no. 12, Dec. 1934, pp. 988–998. Report on experimental study of transportation of sand mixtures and similar debris made at the hydraulic laboratory of Padua Institute of Technology, Italy, for checking the work previously done by H. Kramer, A. Schoklitsch, H. Krey, C. K. Gilbert, and others.

UNITED STATES. Civil Engineering in Missouri Valley. *Eng. News-Rec.*, vol. 114, no. 5, Jan. 31, 1935, pp. 155–156. Progress notes on engineering work in Kansas City, on the Fort Peck spillway models, and on the Missouri River channel.

HYDRO-ELECTRIC POWER PLANTS

FEDERATED MALAY STATES. Perak River Hydro-Electric Power Scheme, B. M. Hellstrom. *Instn. Civ. Engrs.—Min. Proc.*, vol. 239, pt. 1, no. 4974, 1934, pp. 3–62, 2 supp. plates. Design and construction of hydro-electric power development of about 27,000 kw, including construction of hollow reinforced concrete overflow dam about 70 ft high.

HYDROLOGY, METEROLOGY, AND SEISMOGRAPHY

GERMANY. Regenbeobachtungen, Wasserstands- und Wassermengenmessungen, F. Reinhold. *Gesundheits-Ingenieur*, vol. 57, no. 32, Aug. 11, 1934, pp. 393–396. Survey of organization of rainfall, stream flow, and gage height observations in Germany; text of two questionnaires used in survey.

IRRIGATION

CANALS. Earthwork, Tunnels, and Structures, South Canal, Station 2 to Station 736, Succor Creek Division, Owyhee Project, Oregon-Idaho. *U. S. Bur. Reclamation—Specifications*, no. 607, 45 pp., 22 supp. sheets. Schedules, specifications, and drawings for construction of 73,400 ft of lined and unlined earth canal having bottom widths of from 14 to 16 ft and water depth of 7 ft, including appurtenant structures.

LAND RECLAMATION AND DRAINAGE

UNITED STATES. Report on Survey of Federal Reclamation in West, F. E. Schmitt and J. W. Haw. *Reclamation Era*, vol. 25, no. 2, Feb. 1935, pp. 29 and 36. Review of findings and recommendations of survey made by authors for U. S. Secretary of Interior; reclamation as fundamental agency of public welfare; payment of construction costs should be resumed; relation of power to irrigation.

MATERIALS TESTING

CONCRETE, PLASTICITY. Plastic Flow of Concrete Under Sustained Stress, R. E. Davis, H. E. Davis, and J. S. Hamilton. *Am. Soc. Testing Matls.—Proc.*, vol. 34, pt. 11, 1934, pp. 354–386. Details and results of tests on plain concrete cylinders and reinforced concrete columns subjected to sustained compressive stress, carried on in Engineering Materials Laboratory of University of California over period of 7 yr; fundamental causes of flow, interrelation between plastic flow and shrinkage, etc., investigated.

CONCRETE, WORKABILITY. Zur Bestimmung der Verarbeitbarkeit von Moertel und Beton, W. Humm. *Beton u Eisen*, vol. 33, no. 12, June 20, 1934, pp. 184–188. Results of tests by Kasp. Winkler & Co., Zurich, Switzerland, of relation between volume-weight of concrete and its workability; tests of penetrability of liquid concrete and its relation to workability.

ROAD MATERIALS, SPECIFICATIONS. Road Materials. *Am. Soc. Testing Matls.—Tentative Standards* (Issued annually) 1934, pp. 652–748. Tentative specifications, methods of testing, and definition.

SUBSOILS. Subgrade Soil Testing Methods, C. A. Hogentogler and E. A. Willis. *Am. Soc. Testing Matls.—Proc.*, vol. 34, pt. 11, 1934, pp. 693–725, (discussion) 726–738. Procedures as developed for routine tests by U. S. Bureau of Public Roads, to determine influence of soils on highway construction; based upon constituent materials, physical properties, and performance; uniform subgrades are tentatively classified into eight groups, identified by definite test limits and requiring different design features in roads laid thereon. Bibliography.

WATER WELLS, TIDE EFFECTS. De Invloed van de Getijbeweging van zeeeen en getijrivieren op de Stijghoogte van Grondwater, J. H. Steggewents. Delft, W. D. Meinema. Diagrs., charts, tables. Influence of tides on water level of neighboring wells; development of formula, based on work of Forchheimer and Terzaghi, for transmission of tides in artesian basins covered by layer of incompletely impervious material; formulas found correct by application to observations made on Dutch and German wells subject to tidal effect. Bibliography. (Brief abstracts in French, German, and English.)

PORTS AND MARITIME STRUCTURES

BREMEN. Harbors of Bremen. *Naut. Gaz.*, vol. 125, no. 2, Jan. 19, 1935, pp. 9–11 and 32–33. Increasing freight trade; free harbors; special transfer facilities; shipowners and merchants.

GDYNIA, POLAND. Port of Gdynia, Poland's Busy Gateway to Sea, J. Ellner. *Mar. Rev.*, vol. 64, no. 10, Oct. 1934, pp. 18–21 and 38. Transformation, within past 10 years, of fishing hamlet on Baltic Sea to well-equipped modern seaport; advantages of location; physical characteristics and facilities of port.

GENOA. Recent Developments at Port of Genoa, B. Cunningham. *Engineering*, vol. 139, no. 3604, Feb. 8, 1935, pp. 133, 134, and 146, and supp. plate. Description of various extensions and improvements made during past 4 years.

GREAT BRITAIN. Improvements to St. Helier's Harbour, Jersey, R. D. Gwyther. *Instn. Civ. Engrs.—Min. Proc.*, vol. 23, no 4951, 1934, 25 pp., 1 supp. plate. Dredging of new channel and construction of new berths in harbor on south coast of Island of Jersey, Great Britain; sweeping of dredged areas; total cost £250,000.

HAIFA, PALESTINE. Construction of Haifa Harbour, E. J. Buckton. *Instn. Civ. Engrs.—Min. Proc.*, vol. 239, pt. 1, no. 4964, 1934, 36 pp., supp. plate. Method of construction of port at approximate expense of 1,000,000 British pounds, including main breakwater one-quarter of a mile long and lee breakwater about half a mile long; use of pre-cast concrete blocks; dredging and reclamation of land; cost data.

MARINE BORERS. Marine Borer Attack Increases Along New England Coast, F. C. Shepherd. *Ry. Age*, vol. 98, no. 1, Jan. 5, 1935, pp. 11–12 and 19–20. Indications of increased activity, with threat to many railway structures, which are being uncovered by new investigating committee. Before Am. Assn. Port Authorities.

PIERS, WELDED STEEL. All-Welded Steel Ocean Pier of Tubular and H-Piles, R. C. Helen. *Eng. News-Rec.*, vol. 114, no. 2, Jan. 10, 1935, pp. 38–39. Construction of welded-steel ocean pier, 2,327 ft long, at Davenport, Calif., under conditions of hazardous wave exposure requiring anchorage to rock bottom; steel trestle pier on ledge bottom resists severe wave action by means of welded connections and steel piles driven into rock.

ROADS AND STREETS

CONSTRUCTION, CALIFORNIA. Rounding Off Slope Tops on California Highways. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, p. 798. Description of light templet made up of four pieces of 1 by 2-in. lumber, 6½ and 7 ft long, used by California division of highways for guide in rounding off tops of cut slopes.

CONSTRUCTION, MICHIGAN. Methods and Cost of Filling for Highway over Swamps, J. W. Cushing and O. L. Stokstad. *Eng. News-Rec.*, vol. 114, no. 4, Jan. 24, 1935, pp. 126–129. Recent practices of state highway department of Michigan as reported to Highway Research Board; warping of alignment due to side slip of clay fill over swamp muck; deep grubbing; full cut through shallow swamps; partial excavation and surcharge; construction over marl; side excavations on old locations; rebuilding over deep swamp; jetting; cost data.

EXPERIMENTAL. Experiments with Road-Mixes and Surface Treatments in California, T. E. Stanton. *Pub. Roads*, vol. 15, no. 11, Jan. 1935, pp. 253–270. Observations on 21 experimental sections covering 10 miles on U. S. 30, beginning at California-Nevada state line and extending southwest; road mixes of crushed stone and gravel aggregates with various types and grades of bituminous materials; surface treatment of road mixes; surface treatments on traffic-bound stone-base course; tests on subgrade soil samples; construction costs.

HIGHWAY ENGINEERING, FUTURE PROBLEMS. Engineering Problems of Future Highway. *Eng. News-Rec.*, vol. 114, no. 3, Jan. 17, 1935, pp. 70–105. Symposium includes the following papers: Highway Research, R. W. Crum; Traffic Surveys, M. McClintock; Highway Rerouting, C. H. Purcell; Rational Road Design, F. T. Sheets; Bridge Design, J. R. Burkey; Roadside Design, M. W. Torkelson; Secondary Roads, B. E. Gray; Highway Safety, E. W. James.

HIGHWAY ENGINEERING, UNITED STATES. Roadbuilders Take Strong Action on Federal Highway Policies. *Eng. News-Rec.*, vol. 114, no. 5, Jan. 31, 1935, pp. 160 and 166. Proceedings of 1935 convention of American Road Builders' Assn., including resolutions and reviews of highway field, engineering progress, contractors' problems, labor restrictions, and equipment developments.

HIGHWAY SYSTEMS, CONNECTICUT. Creating Tertiary Roads by Supervised Town Aid, L. H. Beebe. *Eng. News-Rec.*, vol. 113, no. 24, Dec. 13, 1934, pp. 754–756. Connecticut, without taking freedom from its towns, is helping them to develop a system of local roads that ties in closely with its primary and secondary highway systems; design and construction; supervision and accounting; maintenance and wear.

MAINTENANCE AND REPAIR. Public Safety Aspects of Road Maintenance, A. McLeod. *Surveyor*, vol. 86, no. 2231, Oct. 26, 1934, pp. 405–406. Control of traffic to give maximum facility of movement; control by restriction; safe road surfaces; economy factor in public safety. Before Highway Engrs. Assn. of Scotland.

RESEARCH. Road Research Capitalized by Wisconsin County, W. E. Barker. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, pp. 788–790. Cost reduced and quality progressively improved by experimentation throughout 3-year program of concrete paving in Sheboygan County, Wis.; trial of designed mix; concrete compacted by roller proved good as average; concrete costs for 1928 compared with 1929, 1930, 1931, and 1932.

TESTING. Device for Measuring Length of Pavement Cores, F. V. Reagel. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, p. 798. Description of device for measuring core length in checking pavement thickness used by Bureau of Materials of Missouri State Highway Department.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE. Settling and Compacting of Activated Sludge, W. Rudolfs and I. O. Lacy. *Sewage Works Journal*, vol. 6, no. 4, July 1934, pp. 647–675. Original experimental studies of effect of temperature, increased and reduced pressure, concentration of sludge, shape of containers, settling at various angles, depth of containers, prolonged aeration, mixing, and concentration of returned activated sludge mixed with fresh solids. Bibliography.

CHEMICAL PROCESS. Chemische Abswasserklaerung? H. Bach. *Gesundheits-Ingenieur*, vol. 57, no. 22, June 2, 1934, pp. 273–276. Critical review of work on precipitation process of sewage treatment done principally in the United States; conclusion that chemical treatment cannot supersede biological processes for treatment of sewage.

CHLORINATION. Effect of Chlorine Dosage Upon Percentage Reduction of B. Coli, W. Rudolfs, J. Ziemba, and H. W. Gehm. *Sewage Works Journal*, vol. 6, no. 6, Nov. 1934, pp. 1094–1102. Results of tests made at Water and Sewage Research Department of New Brunswick, N.J.; chlorine consumption rate shown to be instantaneous; B. coli in both fresh and stale sewages; percentage of B. coli reduction depends upon amount of chlorine added and not upon percentage of chlorine demand satisfied. Bibliography.

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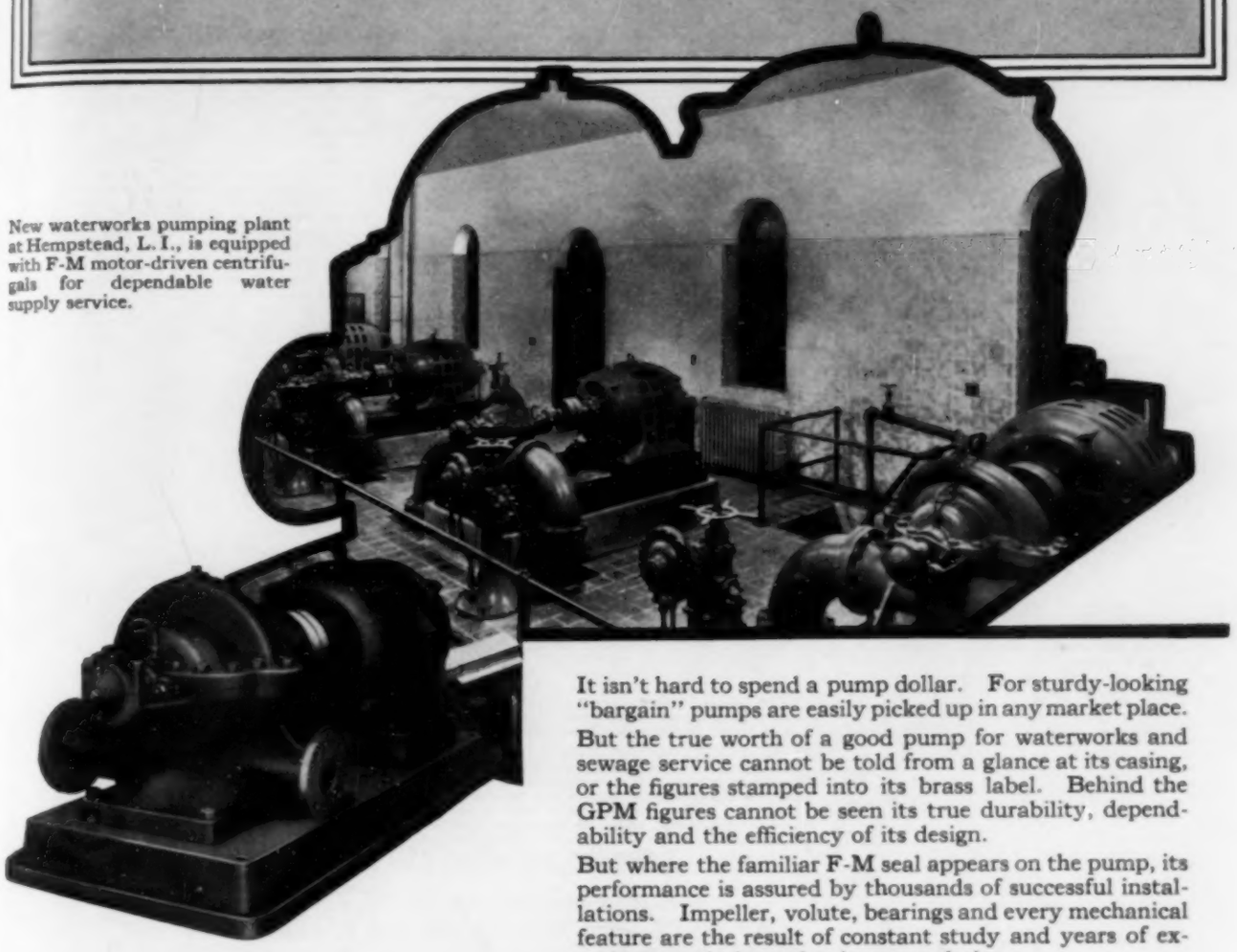

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COAL MINES AND MINING, STREAM POLLUTION. Purification Problems Resulting from Pollution by Mine Waters, E. C. TRAR. *Water Works Eng.*, vol. 87, no. 14, July 11, 1934, pp. 774–775. Effect of acid drainage on streams; mine-water pollution in West Virginia; sealing abandoned mines partly successful; progress in application of basic methods; neutralization treatment slowly adopted; disposal of sludge; germicidal action of mine water; point beyond which water cannot be purified. Before West Va. Conference on Water Purification.

DAIRY WASTES. Purification of Creamery Waste on Filters at Two Iowa Creameries, W. E. Galligan and M. Levine. *Ia. State College Agriculture & Mechanic Arts—Off. Publ.—Bul.*, no. 115, vol. 32, no. 44, Apr. 4, 1934, 39 pp. Attempts at treatment of creamery waste; construction and operation of two treatment plants; purification of settled creamery waste by filtration; résumé of results at Glidden.

INDUSTRIAL. Beseitigung Industrieller und gewerblicher Abwaesser, F. Langbein. *VDI Zeit.*, vol. 78, no. 51, Dec. 22, 1934, pp. 1480–1482. Characteristic properties of industrial sewage; classification of industrial wastes; review of engineering progress in disposal and utilization of industrial sewage.

OPERATION OF PLANTS, CONNECTICUT. Sewage Treatment in Greenwich, Connecticut, G. E. Griffin. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934, pp. 928–949. Operating data, including gas production; sludge temperature figures for sewage disposal plants treating sewage from high class residential town 30 miles from New York City. Before New England Sewage Works Assn.

OPERATION OF PLANTS, INDIANAPOLIS. Operation Experiments at Indianapolis Activated Sludge Plant, C. K. Calvert and D. E. Bloodgood. *Sewage Works Journal*, vol. 6, no. 6, Nov. 1934, pp. 1068–1072. Results of experiments indicating that plain aeration of sewage in present plant removes greater weight of solids and biochemical oxygen demand than can be removed by same plant using activated-sludge process; no reasonable increase in amount of submerged contact surface will produce increased purification commensurate with cost of installation; pre-aeration, as practiced in this experiment, is not warranted.

OPERATION OF PLANTS, NEW YORK. Digestor Overflow Liquor—Its Character and Effect on Plant Operation, A. J. Fischer. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934, pp. 956–965 (discussion), p. 965. Review of factors influencing character of overflow; methods of disposing of overflow liquor and their effect on plant operation. Bibliography. Before N.Y. State Sewage Works Assn.

PLANTS, GREAT BRITAIN. Regional Sewerage and Sewage Disposal. *Surveyor*, vol. 86, no. 2231, Oct. 26, 1934, pp. 401–402. Description of first section of Coleshill works of Birmingham, Tame, and Rea District Drainage Board serving rapidly growing district with present population of 50,000; method of purification; method of utilizing waste heat; total cost 144,000 pounds.

PROGRESS. Water Supply and Sanitary Engineering in 1934. *Engineer*, vol. 159, nos. 4121 and 4122, Jan. 4, 1935, pp. 25–26, and Jan. 11, pp. 39–40. Review of progress in London and other British districts; Shing Mun valley waterworks, Hong Kong; sanitary engineering and water supply in France.

SEWERS, CONSTRUCTION. New Development in Sewer Construction, A. M. Rawn. *Water Works & Sewerage*, vol. 81, no. 11, Nov. 1934, pp. 391–393. Standard acidproof joint for vitrified clay bell-and-spigot pipe; inner form used in pouring acidproof cement joints in Los Angeles, Calif.; use of new pipe in trunk sewer project.

SEWERS, SLIME. Slime Growths in Sewers, F. E. DeMartini. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934, pp. 950–955. Biology of sewer slime; method of control and prevention. Bibliography. Before Calif. Sewage Works Assn.

SLUDGE, BALTIMORE. Vacuum Filtration of Elutriated Sludge, C. E. Keefer and H. Kratz, Jr. *Sewage Works Journal*, vol. 6, no. 5, Sept. 1934, pp. 845–894 (discussion), 894–896. 1933–1934 experiments at Baltimore Sewage Works, indicating possibility of reducing by more than 50 per cent the amount of ferric chloride needed to coagulate digested sewage sludge prior to filtration; effect on filter capacity of reducing amino ammonia nitrogen, of mixing raw and digested sludge, and of elutriating fresh and digested sludge with various proportions of water. Before N.Y. State Sewage Works Assn.

SLUDGE, DRAINABILITY. Relation Between Drainability of Sludge and Degree of Digestion, W. Rudolfs and H. Heukelekian. *Sewage Works Journal*, vol. 6, no. 6, Nov. 1934, pp. 1073–1081. Experimental study made at New Brunswick, N.J., indicating that drainability increased with increase in gas production until, and shortly after, peak of gas formation had been reached; storage decreased drainability; chemicals, such as alum, may help drainability.

SLUDGE, DRAINAGE. Sludge Dewatering at Baltimore Sewage Works, C. E. Keefer. *Water Works & Sewerage*, vol. 81, no. 12, Dec. 1934, pp. 403–407. Study of economics of natural drinage vs. vacuum filtration; dewatering of sand bed; experiments with centrifuge; sludge filtration; filtering elutriated sludge; elutriating water; cost of filtering elutriated sludge.

SLUDGE, STABILITY. Increasing Salability of Sludge, P. N. Daniels. *Water Works & Sewerage*, vol. 81, no. 8, Aug. 1934, pp. 277–279. Experience of Sewage Treatment Works of Trenton, N.J.; suggested procedure for creating sludge demand; operation of disintegrator; value of sludge as soil conditioner; question of producing "special" or fortified sludge; materials used in manufacture of fertilizer; selection of mix and blending; results of application, selling methods.

SOUTH AFRICA. Sewage Disposal in South Africa, E. J. Hamlin. *Surveyor*, vol. 86, no. 2231, Oct. 26, 1934, pp. 409–410. Statistical data on sewage disposal plants of South Africa; interest in sewage disposal; climatic conditions; sewage disposal at coast towns; inland sewage disposal; screening; detritus pits; sedimentation tanks; treatment of tank effluent; sludge digestion; activated sludge method of treatment; sewage disposal on mining properties. Abstract from *Instn. Sanitary Engrs.—Journal*, Oct. 1934.

STRUCTURAL ENGINEERING

ARCHES, CONCRETE. Beitrag zur Frage der Verlagerung der Bogenachse bei eingespannten Gewoelben, H. Fink. *Beton u Eisen*, vol. 33, no. 13, July 5, 1934, pp. 204–207. Theoretical mathematical discussion of layout of axis of fixed concrete arches.

BEAMS, CONCRETE. Vereinfachte Berechnung des Eisenbetonbalkens, F. Emperger. *Beton u Eisen*, vol. 33, no. 13, July 5, 1934, pp. 207–209. Simplification in method of design of reinforced concrete beams, with special reference to beams reinforced with high-grade steel.

DEFORMATION. Vibrating Wire Method of Measuring Deformations, H. N. Davidenkoff, *Am. Soc. Testing Matls.—Proc.*, vol. 34, pt. 11. 1934, pp. 847–860, (discussion) 861. Commentary on method for measuring deformations in engineering structures, application in verification of technical data forming basis of construction projects carried out by U.S.S.R. Bibliography.

ELASTICITY. Examen critique des bases et des méthodes de la théorie de l'élasticité, R. L'-Hermite. *Entreprise Francaise*, vol. 4, no. 40, Apr. 25, 1934, pp. 17–22. Critical analysis of principles and methods of theory of elasticity; kinematic study of deformations; study of elastic forces; thermodynamic equilibrium; relation between tensile stresses and displacements.

FLOORS, SOUNDPROOFING. Directives pour la construction des planchers insonores. *Entreprise Francaise*, vol. 4, no. 39, Mar. 25, 1934, pp. 10–12. Recommendations for construction of soundproof flooring; results of experiments made in Prague, Czechoslovakia, by author in conjunction with Kallauner, Zahradnicek, and Alejnikov, for comparing properties of different floor coverings. French abstract from *Bauunternehmer* Feb. 1934.

FRAMED STRUCTURES, DESIGN. Zur Berechnung prismatischer Turmskelettkonstruktionen nach dem Formaenderungsverfahren, R. Schwarz. *Beton u Eisen*, vol. 33, no. 16, Aug. 20, 1934, pp. 252–258. Design of hexagonal and octagonal multi-story framed prismatic towers on basis of deformation theory; usual theory of design based on resolution of 3-dimensional system into series of 2-dimensional ones was found unsatisfactory; numerical examples.

FRAMED STRUCTURES, RIGID. New Design Developed for Steel Rigid Frames. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, pp. 799–800. Design by Weiskopf and Pickworth, involving application of tee or split-beam flange-girder principle.

TUNNELS

RAILROAD, ITALY. Der grosse Apenniu-Tunnel der "Direttissima" Bologna-Firenze, E. Thomann. *Schweizerische Bauzeitung*, vol. 103, nos. 19 and 20, May 12, 1934, pp. 217–221, and May 19, pp. 229–235. Description of, and comments on, design and construction of great Appenine tunnel, 18.5 km long, on railroad cut-off between Bologna and Florence, Italy.

VEHICULAR, VENTILATION. Ventilating Mersey Tunnel. *Colliery Eng.*, vol. 11, no. 128, Oct. 1934, pp. 349–359. Discussion of ventilating problems and description of equipment, including fans having total capacity of 10,000,000 cu ft per min; system of centralized remote control.

WATER SUPPLY, CONSTRUCTION. Driving Water Tunnel Under Continental Divide. *Eng. News-Rec.*, vol. 113, no. 24, Dec. 13, 1934, pp. 752–754. Progress report on construction of 3.85-mile Twin Lakes Tunnel under Continental Divide, at Independence Pass, Colo.; steel-faced dams; work in high altitudes; construction of rock-fill diversion dam; scraper mucker; drilling and shooting diagram; fast driving cycle.

WATER TREATMENT

ANALYSIS, LOS ANGELES. Quality of Los Angeles Water Supply, R. F. Goudey. *Water Works & Sewerage*, vol. 81, no. 9, Sept. 1934, pp. 297–299. Mineral, sanitary, chemical, and bacteriological qualities; recent experiences in control of chlorination.

FILTRATION PLANTS, DRAINAGE. Design of Pipe Laterals for Underdrainage Systems of Rapid Sand Filters, J. E. Carson. *Am. Water Works Assn.—Journal*, vol. 26, no. 8, Aug. 1934, pp. 1035–1045. University of California tests of combined effect of pressure and velocity in lateral upon discharge through hole therein used, in design of underdrain system for gravity filter; effect of inclined holes; proper spacing of laterals; pressure head and velocity in lateral; effect of fluctuation of discharge on uniformity of distribution of wash water.

PURIFICATION. Purification Division Discusses Wide Range of Topics. *Water Works Eng.*, vol. 87, nos. 13 and 14, June 27, 1934, pp. 717–720; and July 11, pp. 771–773. Report of proceedings of Purification Division at 1934 Convention of American Water Works Association, including abstracts of following papers: Air-Dilution Method of Odor Determination in Water Analysis, G. M. Fair; Occurrences and Control of Iron Bacteria in Water Supplies, K. W. Brown; Equipment for Chlorination of Small Water Supplies, C. R. Cox; Handling Chlorine to Avoid Trouble, L. L. Hedgepeth; Review of Status of Ammonia Chlorine Process, M. C. Smith; Study of Efficiency of Ammonia Chlorine Process, A. E. Griffin; Chlorine and Orthotolidine Test in Presence of Nitrites, R. Hulbert; Coagulation with Iron Compounds, A. P. Black; Significant Features of Chicago Amoebic Dysentery Outbreak, J. I. Connolly.

RAILROADS, WATER SUPPLY. Report of Committee XIII—Water Service, Fire Protection and Sanitation. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 370, Oct. 1934, pp. 133–163. Value of water treatment; methods of malaria control; track pans for locomotive water supply; analysis of chemicals used in water treatment; disinfectants, fumigants, and cleaning materials; regulations of National Board of Fire Underwriters pertaining to protection of railway property.

SOFTENING, CANADA. Softened Water Brings Economies. *Modern Power & Eng.*, vol. 29, no. 1, Jan., 1935, pp. 14–15. Etobicoke Township, near Toronto, softens municipal water supply at cost of about 14 cents per 1,000 gal.; when both wells are pumping and delivering from 975 to 1,050 gpm, power demand is 53 hp; drawdown on No. 1 well is about 17 ft, while that of No. 2 is about 12 ft; notes on and illustrations of equipment.

TASTE AND ODOR REMOVAL. Trend of Modern Taste and Odor Control, F. E. Stuart. *Water Works & Sewerage*, vol. 81, no. 9, Sept. 1934, pp. 327–328. Powdered activated carbon process; importance of sludge stabilization; trend of modern taste and odor control; activated carbon in wash water holds promise.

UNITED STATES. Treatment of Public Water Supplies and Their Industrial Use, 1922–1932, W. D. Collins, W. L. Lamar, and E. W. Lohr. *Am. Water Works Assn.—Journal*, vol. 26, no. 9, Sept. 1934; pp. 1277–1280. Comparison of conditions of source and treatment of larger water supplies in the United States in 1922 and 1932.

WATER WORKS ENGINEERING

NEW WATER SUPPLY. Groundwater Cut-off Wall Provides New Water Supply, A. B. McDaniel. *Eng. News-Rec.*, vol. 113, no. 24, Dec. 13, 1934, pp. 757–759. Construction of reinforced concrete cut-off wall, of 15-ft maximum depth, for intercepting underground flow along floor of valley, to be collected in gallery for supply of Harrisonburg, Va.

VIRGINIA. First Meeting of Virginia Section, A. W. W. A. *Water Works & Sewerage*, vol. 81, no. 9, Sept. 1934, pp. 305–309. Proceedings of 1934 meeting, including abstracts of following papers: Effect of Temperature and Hydrogen Ion Concentration on Efficiency of Chloramine and Chlorine, L. Frayser; Uses of Activated Carbon in Water Treatment, F. E. Stuart; Meter Reading, Billing, and Collecting, H. B. Rice; Mechanical Aids to Office Management in Small Municipalities, W. P. Adams; Need for Master Meters and Recording Instruments, R. J. Jeveque; Recent Trends in Water Purification Practice, J. E. Jordan; Coagulants Used in Water Purification and Why, L. L. Hedgepeth; Corrective Treatment for Cold Water Corrosion by Public Water Supplies, E. S. Hopkins; Effect of Meterization on Revenues and Consumption, E. H. Rueh!; Operation of Small Sewage Treatment Plants, J. R. Abbitt; and Sewage Treatment for Small Municipalities, M. Johnson.

WATER LAW. Important Water Supply Laws, L. T. Parker. *Water Works Eng.*, vol. 87, no. 16, Aug. 8, 1934, pp. 875–877. Ordinances contradicting state laws always void; water company liable for fire loss; illegal ordinance not effective; water rate authorization law valid; water bills as liens on property; state law must authorize property liens.

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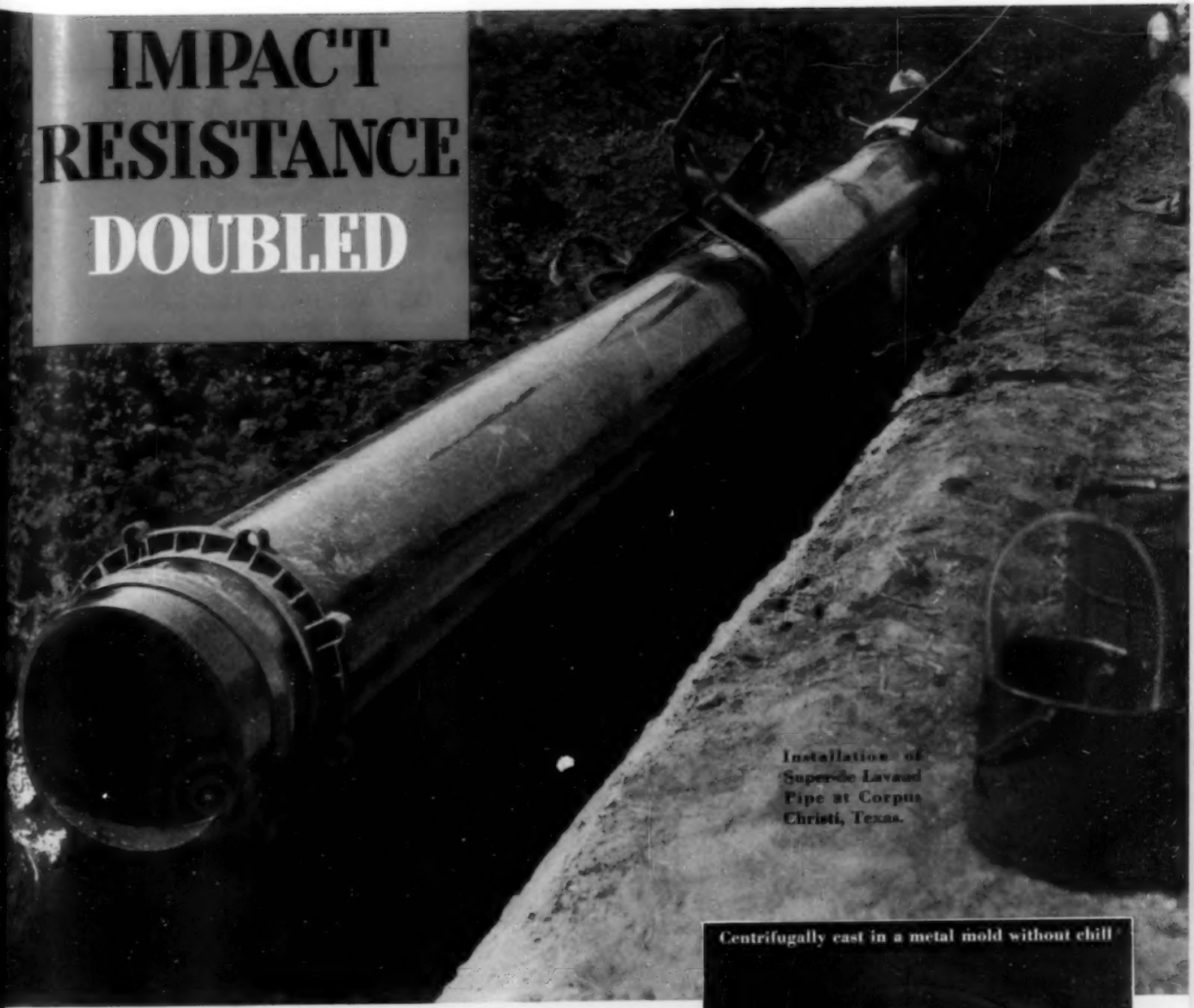

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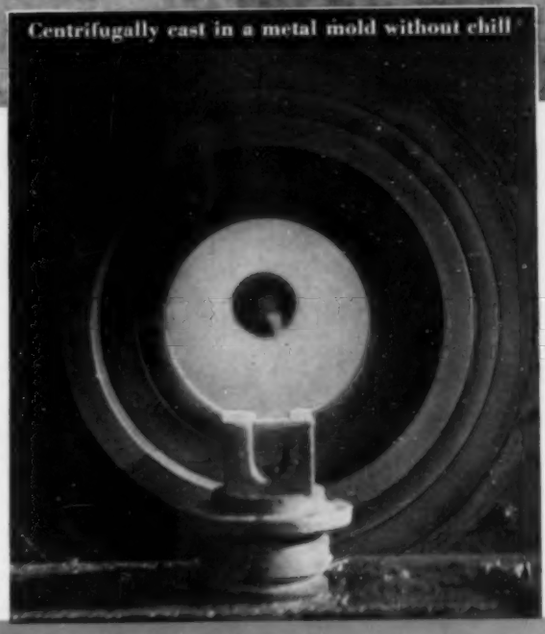

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BRIDGES

ARCHES, TESTING. Tests on Full-Size Modern Arches in Franklin Institute Museum. F. N. Kneas. *Franklin Inst.—Journal*, vol. 219, no. 3, Mar. 1935, pp. 263–283. Results of tests of hingeless and 3-hinged concrete and steel arches up to 55 ft in span; fixity of abutments; effect of continuity; effect of deck structures; comparison between recorded and calculated deflections; effect of rib-shortening; calculated deflections; properties of hingeless concrete arch rib; derivation of influence lines; verification of calculated deflection.

CONCRETE ARCH, CONSTRUCTION. Fixed Derricks on Towers Build High Concrete Bridge. *Eng. News-Rec.*, vol. 114, no. 8, Feb. 21, 1935, pp. 282–284. Construction of Calvert Street bridge in Washington D.C., consisting of three arches of 146-ft span and having total length of 751 ft; six stiff-leg steel derricks cover entire site; steel-truss centering for arches; all concrete truck-mixed on job; precast soffit slabs between arch ribs.

CONCRETE ARCH, FRANCE. Les ponts en béton armé de Laifour et d'Anchamps, sur la Meuse, M. Cayla. *Génie Civil*, vol. 105, no. 26, Dec. 29, 1934, pp. 602–604. Features of hollow, 3-hinged, concrete-arch bridges recently constructed at Laifour and Anchamps, France, each having single-arch span of 97 m, height of 9 m, and width of 5 to 7.50 m.

CONCRETE GIRDER, WASHINGTON. Continuous Concrete Girders Use Steel Hanger Joints, T. D. Hunt. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, pp. 389–391. Design and construction of continuous concrete-girder bridge, 570 ft long, mid-way between Seattle and Tacoma, Wash., consisting of six girder spans from 80 ft to 100 ft in length; suspension joint used at one-third points in each of 90-ft spans; these joints, which are points of contraflexure for dead load, determined 260-ft length of unjointed central portion of bridge; suspended load at joints carried by short steel eye-bars and pins.

DESIGN. Application of Theory of Influence Equations for Analysis of Secondary Stresses in Truss Bridges, T. Mikuriya. *Civ. Eng. Soc. Japan—Journal*, vol. 21, no. 1, Jan. 1935, pp. 79–86. Mathematical analysis and solution of numerical example. (In English, with Japanese abstract, pp. 85–86.)

MASONRY. Reinforced Brick Masonry Used in Ohio Bridge, J. R. Burkey. *Eng. News-Rec.*, vol. 114, no. 9, Feb. 28, 1935, pp. 320–321. Design and construction of Sugar Creek Bridge, Tuscarawas County, consisting of two 32-ft spans carrying roadway 24 ft wide and two 3-ft refuge walks; substructure, railing, and sidewalks utilise reinforced brick-work, while deck is of concrete T-beam construction.

PIERS, CONSTRUCTION. Planting Bridge-Pier Work for Efficient Concreting. *Eng. News-Rec.*, vol. 14, no. 9, Feb. 28, 1935, pp. 305–308. Design of concreting plant, including batchers and pavers, for construction of piers and abutments for two Cape Cod Canal bridges located 4 miles apart; total job of 70,000 cu yd of concrete involved seal pours of 133 yd per hr and irregular and small pours thereafter; battery of five paving mixers discharged into bottom-dump buckets handled by four derricks and cranes.

RAILROAD, TESTING. Recent Practice in Testing of Bridges in India—I. *Ry. Gaz.*, vol. 62, no. 13, Mar. 29, 1935, pp. 607–611. First of series of articles giving classification of tests, description of many and various instruments used, and number of special and typical tests in each class.

RAILROAD, WELDING. Keeping Old Viaduct Out of Scrap Pile. *Ry. Eng. & Maintenance*, vol. 31, no. 1, pt. 1, Jan. 1935, pp. 25–27. How Terminal Railroad Association of St. Louis restored severely corroded structure to service by electric arc welding.

STEEL, CONSTRUCTION. Dry Ice and Alcohol Used to Shrink Hub in Girder, A. W. Brown and E. V. David. *Steel*, vol. 96, no. 2, Jan. 14, 1935, pp. 22–24. Shrink-fit problem that occurred in construction of four 95-ft girders to be used on bascule bridge over Shrewsbury River in New Jersey; cylindrical container constructed so that each of four bearing hubs could be placed in it, in turn, for cooling; insulated to keep out heat; alcohol as heat-transfer medium; shrinkage predetermined; fire hazard considered.

STEEL, DESIGN. Details of Design That Influence Steel Bridge Economy, A. F. Jordan. *Eng. News-Rec.*, vol. 114, no. 10, Mar. 7, 1935, pp. 354–355. Suggestions and elementary facts derived from study of fabricating-shop practice and costs; truss bridges; girder bridges.

VIADUCTS, DESIGN. Rapid and Concise Method of Analyzing Rigid Viaduct Bents, L. C. Maugh. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, pp. 379–380. Outline of method similar to one presented by K. Calisev at Zagreb, Yugoslavia, in dissertation on "Solution of Vierendeel Systems by Successive Approximations"; graphical charts and numerical examples.

BUILDINGS

RAILROAD. Report of Committee VI—Buildings. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 373, Jan. 1935, pp. 579–630, 3 supp. plates. Preparation of specifications for railway buildings; bus terminal buildings; vermin and ratproofing in buildings; mill-type and other heavy wood construction for buildings; study of economic value of various basic and composite materials used in building construction and maintenance.

RECONSTRUCTION. Large Los Angeles Store Given New Strength and Appearance, E. L. Mayberry. *Eng. News-Rec.*, vol. 114, no. 12, Mar. 21, 1935, pp. 415–417. Structural repairs and modernization of facade of the J. W. Robinson Company's 7-story building, in Los Angeles, damaged by recent earthquake; tying buildings together; wall repair; new facing consists of terra-cotta blocks in lower two stories and of tile in upper stories; anchorage of terra-cotta to concrete backing.

CITY AND REGIONAL PLANNING

UNITED STATES. Long-Range Planning Advocated by National Resources Board. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, pp. 796–797. Broad planning for use of land, water, and mineral resources is recommended in first report of U. S. Federal board; public works as agency of recovery; extensive mapping proposed; state and regional planning; public construction and employment; future volume of public works.

CONCRETE

BOULDER DAM PROJECT. Progress on Boulder Dam. *Engineer*, vol. 159, nos. 4126, 4127, 4128, and 4129, Feb. 8, 1935, pp. 154–155; Feb. 15, pp. 170–172; Feb. 22, pp. 196–197; and Mar. 1, pp. 222–223 and 226; see also editorial comment, p. 227. Feb. 8: Special low-heat cement specified for greater part of dam; system of cooling of concrete employed for dissipation of heat of hydration. Feb. 15: Forms and casting method. Feb. 22: Cooling operations. Mar. 1: Intake towers and spillways; power house and penstocks.

CONSTRUCTION, UNITED STATES. Progress and Possibilities in Concrete Discussed. *Eng. News-Rec.*, vol. 114, no. 9, Feb. 28, 1935, pp. 323–326. Proceedings of 1935 annual meeting of American Concrete Institute, including abstracts of papers on special cement trends, portland-pozzolan cements, effect of brands and types of cement, vibration, modern concepts and structures, and varied aspects of concrete.

PIPE, TESTING. Pre-stressed Concrete Pipe Tested at Purdue, R. B. Crepps. *Eng. News-Rec.*, vol. 114, no. 8, Feb. 21, 1935, p. 275. Experimental studies on 30, 42, and 60-in. pre-stressed concrete pipes; measurements of stresses in steel rods and concrete when pipes were being pre-stressed and with internal fluid pressures; normal bond between steel and concrete prevented by coating on rods at time of fabrication; hoops and rods provided with threaded ends and nuts in castings in wall of pipe pre-stressed in tension, in order to induce compression in concrete.

DAMS

CONSTRUCTION, CABLEWAYS. Twin Cableways of Long Span Place Concrete at Norris Dam. *Eng. News-Rec.*, vol. 113, no. 24, Dec. 13, 1934, pp. 747–750. Description of two traveling cableway units of 1,928-ft span for placing 1,000,000 cu yd of concrete; high towers erected with rivet bolts for easy dismantling; floodlights suspended between towers; operating machinery.

GEOLOGY. Selection of Suitable Site for Construction of Dam at Umed Sagar, Jodhpur State, Rajputana, F. F. Fergusson. *Geol. Min. & Met. Soc. India—Quarterly Journal*, vol. 5, no. 4, Dec. 1933, pp. 115–129, 8 supp. plates. Geological study and drilling exploration of foundation for earth dam, 50 ft high, for Jodhpur City in India; construction of masonry corewall to depth of 30 ft below stream bed; data on seepage from dam.

HYDRAULIC FILL, CONSTRUCTION. Deep Sheet-pile Cut-off Wall for Fort Peck Dam. *Eng. News-Rec.*, vol. 114, no. 2, Jan. 10, 1935, pp. 35–38. Driving of sheet-pile cut-off to maximum depths of 150 ft into shale requiring traveling towers nearly 200 ft high, to handle longest piles, jet pipes, and hammers; piles are spliced in air by welding; grout injected in holes 40 ft deep to seal shale and bentonite seams; servicing plant.

HYDRAULIC FILL, TESTING. Field-Testing Devices for Hydraulic Fills, E. A. Rowe. *Eng. News-Rec.*, vol. 114, no. 5, Jan. 31, 1935, pp. 150–152. Description of simple field apparatus used on El Capitan Dam, San Diego, Calif., including tool for sampling core, balance for determining water content and voids and apparatus for screen analysis; screen-analysis device.

MOVABLE, COSTS. Dam No. 6, Upper Mississippi River. *Eng. News-Rec.*, vol. 113, no. 25, Dec. 20, 1934, p. 310. Unit costs on construction of roller gate dam for which lowest bid was $1,668,442.

FLOOD CONTROL

CALIFORNIA. Alluvial Fan Flooding: Montrose, California, Flood of 1934, W. D. Chawner. *Geographical Rev.*, vol. 25, no. 2, Apr. 1935, pp. 255–263. Data on flood of 1934 at Montrose, Calif.; character of flood sediments; causes of flood; protection against future floods.

RIVERS, IMPROVEMENTS. Work of River Trent Catchment Board. *Engineer*, vol. 159, nos. 4126 and 4127, Feb. 8, 1935, pp. 156–157, and Feb. 15, pp. 176–177. Catchment area is 4,029 sq miles: works fall under three main headings—maintenance, improvement of existing works, and new works—each of which is discussed. From Triennial Report of Board for period ending Oct. 31, 1934.

FOUNDATIONS

BRIDGE PIERS, CONSTRUCTION. Sinking Open Cofferdams Through Glacial Drift. *Eng. News-Rec.*, vol. 114, no. 1, Jan. 3, 1935, pp. 1–5. Methods of sinking open cofferdams through boulder-laden and water-bearing material at pier sites of three new Cape Cod Canal bridges; difficulties overcome by elaborate well-point installation and tedious and careful excavation.

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RETAINING WALLS, DRAINAGE. Stone for Vertical Drains Held by Perforated Barrels. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, p. 258. Novel method of installing vertical blind drains behind abutments and retaining walls developed at Syracuse, N.Y., on New York Central track-elevation project.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

DUST SURVEY. Dust of Peking, M. Yung-chi. *Geol. Soc. China—Bul.*, vol. 13, no. 4, 1934, pp. 627–646. Study of composition, texture, and origin of dust of Peking; relation of dust accumulation to direction and velocity of wind; mechanical and mineralogical analysis; comparison of dust with typical loess in northern China; conclusion is that dust is conveyed by wind from northwest plateau region. Bibliography.

RAIN AND RAINFALL, CYCLES. Precipitation and Tree Growth in Harney Basin, Oregon, L. T. Jessup. *Geographical Rev.*, vol. 25, no. 2, Apr. 1935, pp. 310–312. Study showing limited agreement between thickness of tree rings and precipitation in region having annual rainfall of about 8.6 in.; smoothed curve showing variation of precipitation as indicated by tree rings for period from 1760 to 1930.

INLAND WATERWAYS

CANALS, EXCAVATION. Horse-Drawn Fresnos Construct Large Canal as Relief Project. *Eng. News-Rec.*, vol. 114, no. 12, Mar. 21, 1935, pp. 422–424. Excavation of 7-mile branch of All-American Canal west of Calexico, Calif.; capacity is to be 2,600 cu ft per sec; width of bottom is 60 ft, side slopes 1½:1, depth of water 11.3 ft, height of bank 15.8 ft, and width of bank crown 20 ft; average quantity of material excavated was 25.25 cu yd per linear-foot of canal.

IRRIGATION

FLUMES. Concrete Floor and Timber Sides Used for Flume in Colorado. *Eng. News-Rec.*, vol. 114, no. 10, Mar. 7, 1935, p. 353. Construction of 1,770 ft of irrigation flume, 20 ft wide, 6.5 ft deep, to replace section of all-timber bench flume on High Line Canal, which diverts water from South Platte River, 21 miles south of Denver; concrete bottom is 9 ft 6 in. thick.

NEW ZEALAND. Irrigation in Canterbury, A. H. Flay. *New Zealand Journal Science & Technology*, vol. 16, no. 4, Jan. 1935, pp. 185–205. Report on progress and results of investigations of agricultural value of irrigation made at Seafield Demonstration and Experiment Station, Mid-Canterbury; permanent-pasture treatment and results. Bibliography.

SILT. Factors Affecting Exclusion of Bed Silt from Canals Taking Off from Alluvial Rivers, C. C. Inglis and D. V. Joglekar. *Gov. Bombay Pub. Works Dept.—Tech. Paper*, no. 52, 1935, 31 pp., 2 supp. sheets. Experiments carried out between 1927 and 1930 at Hydrodynamic Research Station of Bombay Public Works Department, near Poona, to determine factors affecting movement of bed silt at offtakes from straight river; "resultant" theory; Gibb's theory of "silt draw"; silt exclusion with curved vanes; effects of divide wall.

LAND RECLAMATION AND DRAINAGE

CULVERTS, DURABILITY. Durability of Culvert Types Under Service Conditions, W. S. Downs. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, pp. 384–385. Rating survey of culverts on highways in West Virginia brings out conclusions on preferable practices in design and construction; effect of water acidity; slope of culvert.

EROSION CONTROL. Vízmosáskoető rőzseművek, A. Trummer. *Viszegyi Kozlemények*, vol. 16, no. 3, July–Sept. 1934, pp. 486–501, 6 supp. plates; see also German, English, French, and Italian abstracts in supp. binding of same issue, 6 pp. Review of Hungarian practice of controlling gullying and erosion of land by means of single and double-plaited brush-work fences; use of small check dams made of dry rubble and heavy wire netting.

MATERIALS TESTING

CONCRETE. Concrete Experimental Work Under Desert Conditions. *Eng. News-Rec.*, vol. 114, no. 4, Jan. 24, 1935, pp. 118–120. Laboratory and field tests of various combinations of concrete for Colorado River Aqueduct; slabs exposed to weather; methods of curing; sulfate-resistant cement; aggregate tests; color tests; monolithic vs. precast pipe; testing sealing compounds on concrete cylinders.

CONCRETE, GEORGIA. Voids and Yield Losses in Concrete, J. E. Boyd. *Eng. News-Rec.*, vol. 114, no. 5, Jan. 31, 1935, pp. 156–157. Tests made by the Georgia State Highway Department indicating that voids in set concrete will not be likely to exceed 80 per cent of the volume of water used; full 100 per cent volume yield not obtainable in practice.

PORTS AND MARITIME STRUCTURES

PIERS, WELDED STEEL. Build All-welded Steel Pier for Loading Bulk Cement, A. F. Davis. *Mar. Rev.*, vol. 65, no. 2, Feb. 1935, pp. 24–25. Pier constructed for Santa Cruz Portland Cement Company by Merritt-Chapman & Scott, San Francisco, to transport bulk cement from plant at Davenport to various points along West coast; Peri carries two 12-in. pipelines for cement, one 6-in. oil line, and one 3-in. water line; all connections made by arc welding; H-column piles used; welding under difficulties; tunnel from silos to pier.

PILES, STEEL CORROSION. Untersuchungen ueber den Angriff von Spundwandeisen in Fluss- und Seewasser, C. Holthaus. *Archiv fuer das Eisenhuettenwesen*, vol. 8, no. 9, Mar. 1935, pp. 379–388 (discussion) 588–589. Investigation of corrosion of sheet piling in river and seawater, to determine approximate life of piles; means of increasing life; results of laboratory tests to determine wear of different varieties of steel.

PORTUGUESE EAST AFRICA. Development and Construction of Port of Beira, I. C. Frampton. *Instn. Civ. Engrs.-Min. Proc.*, vol. 239, pt. 1, no. 4967, 1934; 21 pp., 1 supp. plate. Design and construction of port in estuary of Buzi and Pungwe rivers; considerations affecting design; deep-water wharf extension; shed-foundation and retaining-embankment; load-tests on various types of foundations; composite piles for shed-foundations; wharf-equipment; harbor dredging; reclamation; moorings.

RAILROAD STRUCTURES. Report of Committee XXV—Waterways and Harbors. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 371, Nov. 1934, pp. 211–241. Definitions of terms; specifications for construction of types of river-bank protection in common use; fender systems for protecting wharves; ore docks or piers on Great Lakes for loading vessels by gravity; harbor structures; economic principles involved in clearances over navigable waterways; cost to railways for construction and operation of bridges over waterways.

ROTTERDAM. Port of Rotterdam, N. T. Koomans. *Nasl. Gaz.*, vol. 125, no. 4, Feb. 16, 1935, pp. 5–8 and 13. Position in world trade; rôle in American commerce; statistical data.

ROADS AND STREETS

ASPHALT. Asphalt Plant Notes, F. H. Stone, Jr. *Roads & Road Construction*, vol. 12, nos. 140, 143, and 144, Aug. 1, 1934, pp. 253–254; Nov. 1, pp. 386–387; and Dec. 1, pp. 418–419. Aug. 1: Mechanical design; screens and hot bins; heating aggregate; batch size. Nov. 1: Laying gang organization; bases; mixtures; asphalt cement; consistency; amount. Dec. 1: Filler; capital costs. Before Instn. Engrs., Australia.

BRICK. New Paving-Brick Technique Developing with Research. *Eng. News-Rec.*, vol. 114, no. 8, Feb. 21, 1935, pp. 291–293. Proceedings of 1935 annual meeting of National Paving Brick Association, including research papers on joint filler and cushion-course materials and on de-aired brick; study of bedding materials; exudation of asphalt fillers; plastic sulfur filler; intrusion of joints by remover; strength tests; de-aired paving brick.

CAST IRON. Cast-Iron Block Pavement at Wilmington, Del. *Eng. News-Rec.*, vol. 114, no. 9, Feb. 1935, pp. 317–318. New type cast-iron block of American design being tested on short section of street carrying heavy truck traffic.

ROAD MATERIALS, BITUMINOUS. Asphaltic Bitumen Emulsions for Road Purposes, F. H. Garner. *Petroleum Times*, vol. 33, no. 836, Jan. 19, 1935, pp. 80–81. Properties of bitumen emulsions affecting their use as road material; principal tests for determining advantageous properties are: water content; sieve test; storage stability tests for short and long periods; tests for coagulation of emulsion at low temperatures; viscosity determination; liability, or rate of breakdown on road. From paper before Soc. Chem. Industry.

SNOW REMOVAL, ONTARIO. Snow Control and Treatment of Icy Surfaces in Ontario, J. Sears. *Roads & Streets*, vol. 77, no. 10, Oct. 1934, pp. 383–384. Changes in equipment and organization of snow removal service; snow fencing; sanding of icy roads. Before Can. Good Roads Assn.

SNOW REMOVAL, WYOMING. Snow Control in Wyoming, G. W. Marks. *Roads & Streets*, vol. 77, no. 9, Sept. 1934, pp. 331–335. History and organization; snow fences erected on top of drifts; wind-rows; Before 1934 Highway Conference, University of Colorado.

VIRGINIA. New Standard for Development of Highway Accessibility to Mountain Scenery. *Roads & Streets*, vol. 77, no. 12, Dec. 1934, pp. 431–436. Design and construction of bituminous surface highway on mountain tops of Shenandoah National Park, Va., at elevation of about 3,000 ft above sea level, including tunnel 300 ft long; parking overlooks; protection of valuable trees.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE, NEW JERSEY. Bacterial Numbers in Activated Sludge Mixtures, H. Heukelekian. *Sewage Works Journal*, vol. 6, no. 4, July 1934, pp. 676–688. Experimental study made at New Jersey Experiment Station on differences in character and performance of activated sludge from standpoint of numbers of bacteria; effect on bacterial numbers of additions of CuCl₂ to activated sludge mixtures; effect of suspended solids concentration of activated sludge mixtures on bacterial numbers and purification; effect of storage of activated sludge mixtures without air on bacterial numbers.

CHEMICAL PROCESS. Two Years' Operating Experience of Modern Chemical-Mechanical Sewage Treatment, Dearborn, Michigan, M. B. Owen. *Sewage Works Journal*, vol. 6, no. 4, July 1934, pp. 742–761. Summary of operating and analytical data, including cost data; results were better than expected.

INDUSTRIAL WASTES. Die Bedeutung des gewerblichen Abwassers in der Abwasserreinigung, H. Moehle. *Gesundheits-Ingenieur*, vol. 57, no. 35, Sept. 1, 1934, pp. 431–435. Problem of industrial waste elimination as affecting sewerage system designs and stream pollution; treatment of industrial waste separately and together with domestic sewage. Before Sewage Disposal Section of Deutsche Gesellschaft fuer Bauwesen.

PLANTS, EQUIPMENT. Chicago Combination Aerator and Clarifier, L. H. Kessler and P. F. Morgan. *Water Works & Sewerage*, vol. 82, no. 2, Feb. 1935, pp. 47–52. Design, operation, and performance tests of Chicago Pump Company's newly developed aerator, combined with clarifier in one tank; effluent launder and weirs; difficulties with laboratory procedures; nitrogen conversion by Chicago aerator; dissolved oxygen and oxygen demand values; settling rates of sludge; power consumption; before Central States Sewage Works Assn.

PLANTS, GERMANY. Neuere Betonbauten der Emschergenossenschaft, Pruess. *Bauingenieur*, vol. 15, nos. 27/28, July 6, 1934, pp. 271–279. Review of new construction of open sewers, lined with precast concrete slabs, also of sewage disposal plants, including sewage digestion plants, for Emschergenossenschaft drainage district, Germany.

RIO DE JANEIRO. Do Tratamento E Eliminaco dos Dejectos no Rio de Janeiro, A. J. C. Del Vecchio. *Revista do Club de Engenharia*, vol. 1, no. 5, Jan. 1935, pp. 261–269. Study of treatment and disposal of sewage in Rio de Janeiro.

SEWERS, CONSTRUCTION. Ground for Sewer Excavation Thawed by Oil Fire, G. F. Brousseau. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, p. 394. Thawing of ground frozen to depth of 18 to 36 in. as practiced in construction of 4-mile sanitary sewers in Braintree, Mass.; cost data.

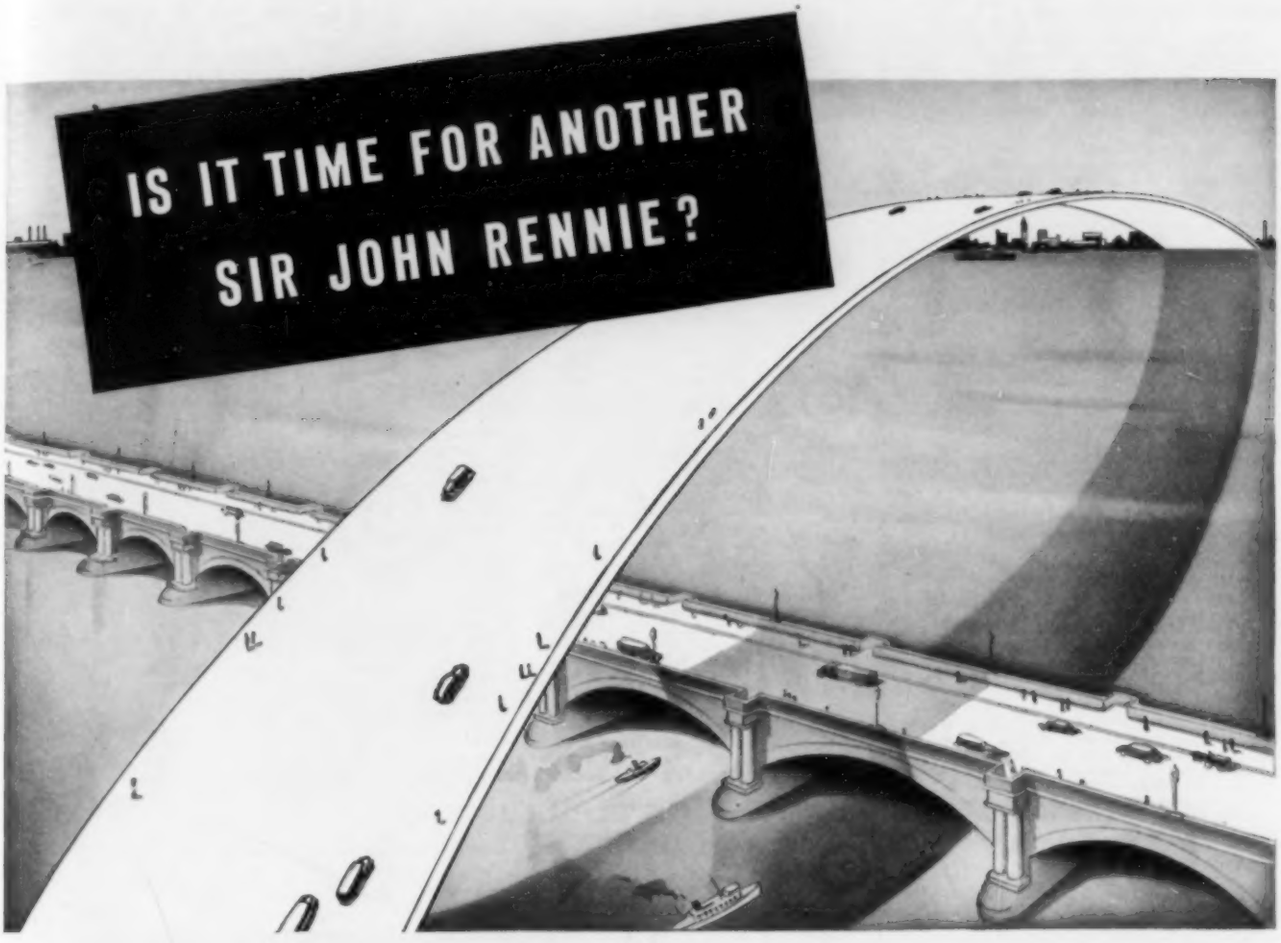
SLUDGE. Adsorption and Flocculation as Applied to Sewage Sludges, A. L. Genter. *Sewage Works Journal*, vol. 6, no. 4, July 1934, pp. 689–720. Experimental study demonstrating that well-known resistance of sewage sludges to coagulation with relatively small amounts of coagulating agents, is not so much due to nature and amounts of colloids present, as it is due to soluble decomposition products, generated in various sludges and accumulated in liquid surrounding sludge particles. Bibliography.

SLUDGE, AGRICULTURAL. Landwirtschaftliche Verwertung des Klaerschlamms aus der Kanalisation, Gouder. *Gesundheits-Ingenieur*, vol. 57, no. 37, Sept. 15, 1934, pp. 461–462. General discussion of agricultural utilization of sewage sludge.

SLUDGE, DRYING BEDS. Making Open Sludge Drying Beds More Effective, F. W. Jones. *Am. City*, vol. 49, no. 12, Dec. 1934, pp. 62–63. Effectiveness of glass-covered sludge beds; operating data on sludge dewatering on sand beds in nine American cities; diagram for computing capacity of sludge drying beds. Before Pa. Sewage Works Assn.

STREAM POLLUTION, STANDARDS. Tendencies in Standards of River and Lake Cleanliness, H. W. Streeter. *Sewage Works Journal*, vol. 6, no. 4, July 1934, pp. 721–733. Present tendencies in reference to standards of pollution; standards of pollution affecting, and not directly affecting, public health interests.

UNITED STATES. Sewage Disposal in United States: General Review, L. Pearse. *Water Works & Sewerage*, vol. 82, no. 2, Feb. 1935, pp. 33–41. Progress in sewage disposal in Sanitary District of Chicago, New York City, Milwaukee, Minneapolis-St. Paul, and Cleveland; types of plants in common use; activated sludge design improvements; chemical treatment; supplementing sedimentation; sludge marketing; sludge incineration; data on stream purification; influence of controlled stream flows on treatment; storm water and industrial wastes; rumored legislation; patents.



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STRUCTURAL ENGINEERING

BEAMS, CONCRETE. Plastizitaetstheorie und Rostgefahr, R. Bortsch. *Beton u Eisen*, vol. 33, no. 14, July 20, 1934, pp. 220–222. Revision of method of design of continuous concrete girders on basis of plasticity theory, taking into account greater liability of highly stressed steel to corrosion by rusting.

BEAMS, CONTINUOUS. Kurventafel zur Bestimmung der groessten Durchbiegungen fuer Balkentraeger auf mehreren Stuetzen, E. Reichdorf. *Bauingenieur*, vol. 15, nos. 23/24, June 8, 1934, pp. 246–247. Construction of graphical chart of maximum deflections of continuous girders.

CONCRETE PRODUCTS, SOVIET UNION. Die neue russische "Instruktion" fuer Eisenbeton-Fertigteile, M. Mayer. *Beton u Eisen*, vol. 33, no. 11, June 5, 1934, pp. 173–176. Enormous expansion in use of concrete products in U. S. S. R.; review of new official instructions for use of various pre-cast concrete elements, requiring that cause be shown why precast standard parts should not be used when planning new structure.

TUNNELS

RAILROAD, LINING. Excellent Plant Expedites Tunnel Lining on Illinois Central. *Ry. Age*, vol. 98, no. 8, Feb. 23, 1935, pp. 290–292 and 296. Commentary on Edgewood cut-off project, completed with PWA funds after suspension of contract work; project comprises alternate single-track line 168 miles long; methods followed in resuming work of lining of Reevesville tunnel; methods of bracing; details of forms; handling concrete.

RESERVOIRS, OUTLETS. Diversion and Outlet Tunnel for Casper-Alcova Dam. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, pp. 250–252. Construction of circular concrete-lined tunnel, 20 ft in diameter, 1,260 ft long, through limestone carrying hot water and gas; grouting checked in flow and produced tight lining; grouting around tunnel; concrete lining plant.

WATER SUPPLY, MARKERS. Spud for Use in Tunnel Marks Line and Grade. *Eng. News Rec.*, vol. 114, no. 7, Feb. 14, 1935, p. 257. Metal spud placed in concrete pier in center of tunnel floor for installing benchmarks in tunnels of Los Angeles aqueduct of Metropolitan Water District in such way as to minimize risk of their being disturbed.

WATER PIPE LINES

FLUSHING. Flushing Water Mains. *Water Works Eng.*, vol. 87, no. 18, Sept. 5, 1934, pp. 981–983. Discussion by practical water-works superintendents of methods of flushing distribution system; frequency and efficiency of pipe line flushing.

FREEZING. Problems in Thawing Frozen Water Pipes in New York State, C. A. Holmquist and A. F. Dappert. *Water Works Eng.*, vol. 87, no. 22, Oct. 31, 1934, pp. 1226–1227. Review of conditions in water pipe lines in New York State during severe winter of 1933–1934; extent of damage due to freezing; increased use of water during severe cold weather; methods employed in thawing pipes; cost of thawing; difficulties experienced in thawing by electricity. Before Am. Water Works Assn.

LEAKAGE, BOSTON. How Boston Stops Water Leak, G. H. Finneran. *Water Works Eng.*, vol. 87, no. 19, Sept. 19, 1934, pp. 1024–1027. Detailed description of representative case; guarding against liability for damage; providing for new pipe; restoring line to service; bracing curved line.

LEAKAGE, NEW YORK. Determination of Leakage on Underground Waste Surveys, F. B. Nelson. *Water Works Eng.*, vol. 87, no. 23, Nov. 14, 1934, p. 1291. Methods adopted in surveys of water waste of the New York City system in Manhattan and the Bronx; determinations of leaks in service pipe; estimating large leaks. Before Am. Water Works Assn.

NOISE ELIMINATION. Noises in Water Piping. *Water Works Eng.*, vol. 87, no. 25, Dec. 12, 1934, pp. 1377–1388. Discussion by practical water works superintendents on noise complaints from consumers—their causes, and remedies for them.

PROTECTIVE COATINGS. Bitumen Coating Applied to Mains While in Service. *Water Works Eng.*, vol. 87, no. 19, Sept. 19, 1934, p. 1055. Process developed in England, which deposits coating on inside of pipe by means of electric current supplied by generator.

WATER RESOURCES

UNDERGROUND. Tracing Ground Water Flows, H. O. Williams. *Water Works Eng.*, vol. 87, no. 17, Aug. 22, 1934, pp. 920–922. Outline of three convenient methods of tracing flow of underground water supplies; dye method; kinds and amounts of dyes; soluble salts method; electrolytic method.

WATERSHEDS, PROTECTION. Sanitation of Watersheds, A. D. Weston. *Water Works Eng.*, vol. 87, no. 25, Dec. 12, 1934, pp. 1370–1373. Problems of watershed sanitation; protection of public water supplies; general laws; sanitary protection of sources; attempt at various water supply legislation; dangers of pollution from forms of recreation; difficulties in protecting supplies.

WATER TREATMENT

ANALYSIS, SPECIFICATIONS. Standard Methods for Water Analysis. *Am. Pub. Health Assn. Year Book*, 1934–1935 (Supp. to *Journal*, vol. 25, no. 2, Feb. 1935), pp. 134–137. Report presented to Laboratory Section of American Public Health Association Sept. 3, 1934.

CHLORINATION. Determination of Residual Chlorine, R. D. Scott. *Water Works & Sewerage*, vol. 82, no. 2, Feb. 1935, pp. 58–60. Tests for residual chlorine; factors affecting orthotolidine test; elimination of false ortho-tolidine tests; elimination of manganese and iron interference; lessening interference caused by nitrites and ferric iron; starch-iodide test; distinction of chloroamines from free or hypochlorite chlorine; comments on previous methods advocated for overcoming false tests. Before 14th Annual Ohio Conference on Water Purification.

COAGULANTS. Coagulants Used in Water Purification and Why, L. L. Hedgepeth. *Am. Water Works Assn.—Journal*, vol. 26, no. 9, Sept. 1934, pp. 1222–1233. Comparative discussion of uses of sulfate of alumina, ammonia alum, sodium aluminate, copperas, chlorinated copperas, ferric sulfate, and ferric chloride. Bibliography.

COAGULATION. Ferric Sulfate Coagulation, P. J. Holton, Jr., and E. L. Bean. *Water Works & Sewerage*, vol. 81, no. 7, July 1934, pp. 229–232. Factors in solution of ferric sulfate; solubility curves for anhydrous ferric sulfate; chemical feed and solution apparatus; comparing results from the use of three different coagulants; effect of pH of filtered water on corrosion of pipe system.

CONFERENCE REPORT. Meeting of Central States Section A. W. W. A. and West Virginia Water Purification Conference. *Water Works & Sewerage*, vol. 81, no. 9, Sept. 1934, pp. 315–321. Proceedings of 1934 annual meeting, including abstracts of following papers and discussions: Licensing Law—Its Effect on Operators, P. Boynton; Public Relations, J. K. Buchanan; Trends in Public Utility Rates and Financing, J. H. Murdoch; Improvements at Wheeling Filtration Plants, A. R. Todd.

DRINKING WATER, IODINE CONTENT. Water and Goiter Problem, N. N. Wolpert. *Water Works Eng.*, vol. 87, no. 23, Nov. 14, 1934, pp 1260–1263. Endemic goiter distribution in world; iodine in water; indicated relationship of fish consumption to goiter incidence; correction by use of iodized salt; iodine content of various fresh food products; addition of iodides to water. Bibliography.

EMERGENCIES. Emergency Water Treatment After Catastrophies, R. F. Goudey. *Water Works Eng.*, vol. 87, no. 26, Dec. 26, 1934, pp. 1423–1426. Efficient methods of quickly safeguarding water supplies in following disasters: Santa Ana typhoid fever epidemic, Santa Barbara earthquake, St. Francis Dam disaster, Long Beach earthquake, and Montrose flood. Before Am. Water Works Assn.

FILTRATION. Mechanical Agitation and Alum Floc Formation, C. Leipold. *Am. Water Works Assn.—Journal*, vol. 26, no. 8, Aug. 1934, pp. 1070–1083. Laboratory experiments made at Winnetka, Ill., shed light on following problems: temperatures and paddle speeds; mixing periods and paddle speeds with various paddle sizes; velocity; plant operations; comparison of laboratory and plant data.

FILTRATION, MATERIALS. Study of Filtering Materials for Rapid Sand Filters—III, J. R. Baylis. *Water Works & Sewerage*, vol. 81, no. 10, Oct. 1934, pp. 352–357. Tests of following materials: anthracite coal, crushed quartz, minchar, crushed glass, cocoanut char, crushed slag, iron ore, and sand; equation for computing filter runs; effect of rate of filtration; experimental results; filter for testing porosity of sand; experimental results coincide very closely with computed results.

FILTRATION PLANTS, OPERATION. Operation of Carl A. McClain Filtration Plant at Eugene, Oregon, F. F. Northrop. *Am. Water Works Assn.—Journal*, vol. 26, no. 8, Aug. 1934, pp. 1085–1092. Operation of recently completed filtration plant of 12-mgd capacity; cost data.

MANGANESE REMOVAL. Manganese and Iron-Removal Plant for Lincoln, Nebr. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, pp. 246–247. Description of manganese-removal plant which will be built adjacent to existing pumping station; settling basin will facilitate adoption of softening treatment in future; aerators will each consist of four beds of coke supported by cypress trays; processes will comprise aeration, contact filtration, and sand filtration; contact filters will be filled with manganese ore; flow will be upward.

PLANTS, LOS ANGELES, CALIF. Operating Experiences at Los Angeles Treatment Plant, R. O. van Meter. *Water Works Eng.*, vol. 87, no. 25, Dec. 12, 1934, pp. 1393–1394. Methods adopted to facilitate work at Wilmington water treatment plant of Los Angeles; operating rates and dosages; chemical feed apparatus; mixing; sedimentation; filters; chlorination; clarifier and filter growths; ferric chloride storage. Before Am. Water Works Assn.

PLANTS, TAMPA, FLA. Manufacture, Use, and Control of Acid at Tampa Water Purification Plant, J. E. Lyles. *Am. Water Works Assn.—Journal*, vol. 26, no. 9, Sept. 1934, pp. 1214–1218. Description of plant for manufacture of sulfurous acid used in removal of objectionable color of water; laboratory control.

TASTE AND ODOR REMOVAL, METHODS. Taste Control of Water Supplies, R. A. Irwin. *Am. Water Works Assn.—Journal*, vol. 26, no. 9, Sept. 1934, pp. 1202–1213. Review of following methods: aeration, pre-chlorination, super-chlorination, and subsequent dechlorination, ammonia chlorine, activated carbon, potassium permanganate, ozone, copper sulfate, and Fuller's earth; extent of taste control; taste problems in Ontario; every water constitutes a different problem. Bibliography.

WATER WORKS ENGINEERING

CALIFORNIA. California Section Holds Record Convention, J. F. Skinner. *Water Works Eng.*, vol. 87, nos. 23 and 24, Nov. 14, 1934, pp. 1268–1269, and Nov. 28, pp. 1319–1323. Proceedings of 1934 annual convention, including abstracts of following papers: Nov. 14: Control of Weed Growths in Reservoir Banks, G. E. Arnold; Design of Chlorination Plants, S. M. Dunn; Emergency Treatment of Water Supplies Following Major Catastrophies, R. F. Goudey; Long Beach Water System, F. S. Porter; Disaster Preparedness, B. Harmon; Life of Water Works Structures, G. A. Elliott; Accomplishments of State in Its Supervision of Dams, G. W. Hawley; Corrosion from Zero Softened Waters, R. L. Derby; Ferric Chloride Treatment of Water, C. G. Hyde. Nov. 28: California Type of Wells, J. A. Wade; Gravel Envelope Type Wells, C. R. Browning; Industrial Pollution of Underground Waters, W. M. Brown; Handling Delinquent Accounts, C. E. Thatcher. Public Relations, M. R. MacKall; Water Rights of Successors of Mexican Pueblos, W. G. Irving; Hydrographic and Meterological Surveys for Water Supply, J. E. Jones; Water Supply for Construction Camps, Metropolitan Water District, C. C. Elder; Coast Range Tunnels, Hetch Hetchy Water Supply, L. W. Stocker.

DROUGHT EFFECT. Water Experiences During Drought. *Water Works Eng.*, vol. 87, no. 23, Nov. 14, 1934, pp. 1270–1271. Discussion by water-works superintendents of their respective experiences with droughts during past summer; methods of conserving supply; necessity of construction of additional supply works.

FINANCING. Are Water Utilities a Good Investment? C. H. Capen, Jr. *Water Works & Sewerage*, vol. 82, no. 2, Feb. 1935, pp. 42–44. Financial analysis of water works utilities leading to conclusion that on the average they are more successful and safer business ventures than most lines of endeavor. Bibliography.

PALESTINE. Palestine, Its Water Supply and Public Health Conditions, I. W. Mendelsohn. *Water Works Eng.*, vol. 87, no. 26, Dec. 26, 1934, pp. 1418–1422. Country—its inhabitants and climate; general water supply conditions; supply prior to World War; Palestine Department of Health; typhoid fever and other intestinal diseases in Palestine; water supply of Jerusalem; supply for English Army; distribution system; additional water supply recommended; construction undertaken; water supply for other cities.

RESERVOIRS, EQUALIZING. Der Saugbehaelter in Wasserversorgungsanlagen, Etc., G. J. Lehr. *Gesundheits-Ingenieur*, vol. 57, no. 37, Sept. 15, 1934, pp. 463–465. Calculation of required capacity of pumping-plant reservoirs used for equalizing inflow from sources of water supply; numerical data.

UNITED STATES. PWA and FERA Work Necessitates Building Improvised Equipment. *Water Works Eng.*, vol. 87, no. 24, Nov. 28, 1934, pp. 1336 and 1339–1340. Proceedings of November meeting of New England Water Works Assn., including abstracts of following papers: Water Supply in British Isles, W. W. Brush; Sanitary Scoring of Public Water Supplies, A. D. Weston; Effective Improvised Equipment, D. W. Foster.

UNITED STATES, RECENT DEVELOPMENTS. Water Supply and Purification Developments During 1934, I. W. Mendelsohn. *Water Works & Sewerage*, vol. 82, no. 1, Jan. 1935, pp. 1–7. Statistical data on 1928–1934 water works and total contracts; review of progress in water treatment; improving status of water works operators; foreign developments; partial list of new water works projects costing $250,000 or more, installed or begun in foreign countries in 1934; national water boards established abroad.

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GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; B.S. in C.E., 1930; over 2½ years varied engineering experience, including highway design and construction, design of sewage disposal plant, regional planning and mapping, drafting, surveying, bridge construction. Desires permanent position in any branch of civil engineering. Willing to work. Location immaterial. Available immediately. C-7666.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E., New York University, 1934. Desires opportunity with engineering firm or oil company. Best references. Location, Texas or Oklahoma. Available immediately. D-3218.

DRAFTSMAN; Jun. Am. Soc. C.E.; age 28; single; 3½ years experience in design and construction of sewers and their appurtenances; 2 years experience in making maps and quantity estimates for river dredging (maps made from aerial photographs). Location and salary secondary. Can give excellent references. Available immediately. D-3919.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 25; graduate of Pennsylvania State College, 1931; 2 years in constructional surveying and concrete inspection; 6 months, bureau of traffic. Desirous of permanent connection and opportunity for advancement. Determined and responsible. Excellent references. D-3920.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; married; B.S. in C.E., Newark College of Engineering; 5½ years experience with state highway department in capacity of assistant civil engineer; 6 months as chief of party on drainage; 3 months on bridge construction. Good mathematician and draftsman. Engineering or teaching desired; location immaterial. D-3695.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; graduate of Manhattan College, 1932; 26; single; 2 years experience, design, construction, and surveying. Excellent references. Desires opportunity in any branch of civil engineering. Available immediately. Location immaterial. D-2310.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; B.S. in C.E., University of New Hampshire, 1934; single; 9 months in building construction; available at a week's notice; desires opportunity in any branch of civil engineering; location secondary. D-3975.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ALBERT DESIGN CHARTS. By O. Albert. Opla Company, P. O. Box 66, East Orange, N.J., $2.40.

These 25 charts present graphically the theories, formulas, and computations involved in reinforced concrete design. Ten charts refer to the design of beams; four to the design of columns; one to slab design; five to continuous beams; and four to the "fixed point" and other theories. Each chart is complete in itself.

ANALYSIS OF FRAMED STRUCTURES. By J. H. Matthews and P. E. Soneson. New York and London, McGraw-Hill Book Co., 1935. 318 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

This book aims to supply a course on the analysis of primary stresses for statically determinate structures. Simplicity in exposition, illustration, and presentation has been attempted, and highly technical language and discussion have been avoided. The material is presented in progressive order from simple concepts to the applications.

BIOLOGISCHE REINIGUNG IN DÜNNER ABWASSERSCHICHT. Untersuchungen an Versuchseinrichtungen neuer und alter Aufbauart. (Beihefte zum Gesundheits-Ingenieur, Reihe 2, Heft 15.) By H. Beger. Munich and Berlin, R. Oldenbourg, 1935. 19 pp., illus., diagrs., tables, 12 × 9 in., paper, 3.80 rm.

The investigations here reported were undertaken in order to compare, from the biological point of view, the various biological processes for purifying sewage. The apparatus devised and the results obtained are reported in full. The tests were made by the Preussische Landesanstalt fuer Wasser-, Boden- und Lufthygiene.

CORROSION, CAUSES AND PREVENTION. An Engineering Problem. By F. N. Speller. 2 ed. New York and London, McGraw-Hill Book Co., 1935. 694 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $7.

This treatise, which is based on a thorough examination of the existing literature of the subject and on the extensive experience of the author, is a comprehensive review of the subject, especially with reference to the ferrous metals. The nature of corrosion, the influence of various factors, and the prevention of corrosion by air, water, steam, chemicals, and electricity are discussed. A selected bibliography is included. This edition has been revised.

DAUERFESTIGKEITSVERSUCHE MIT SCHWEISSVERBINDUNGEN. Bericht des Kuratoriums für Dauerfestigkeitsversuche im Fachausschuss für Schweisstechnik beim Verein deutscher Ingenieure, durchgeführt 1930 bis 1934. Berlin, VDI-Verlag, 1935. 46 pp., illus., diagrs., charts tables, 12 × 9 in., paper, 8.50 rm.

In 1930 the Welding Committee of the Verein deutscher Ingenieure undertook an elaborate investigation of the fatigue resistance of welded joints. The experiments, which were made in various laboratories during the next four years, are described in this report. The report is an important contribution to the subject of the behavior of welded connections in bridges and other structures.

DER EINFLUSS VON FEUCHTIGKEIT, KORNUNG UND TEMPERATUR AUF DIE WARMELEITFAHIGKEIT KORNIGER STOFFE (Die Leitfähigkeit des Erdbodens). (Beihefte zum Gesundheits-Ingenieur, Reihe 1, Heft 33.) By O. Krischer. Munich and Berlin, R. Oldenbourg, 1934. 26 pp., diagrs., charts, tables, 12 × 9 in., paper, 4.80 rm.

The results of experiments undertaken to determine the heat conductivity of earth. The principal constituents of earth have been systematically examined to ascertain the effects of dampness, grain size and shape, and volumetric weight upon their conductivity.

ELIMINATION OF TASTE AND ODOR IN WATER. By J. R. Baylis. New York and London, McGraw-Hill Book Co., 1935. 392 pp., illus., diagrs., charts, tables, 9 × 6 in., $5.

This review of processes for improving the palatability of water supplies brings together much information, which has hitherto been widely scattered, and supplements it with the results of researches by the author. The book provides an account of the present state of the art that will be of direct value to those in charge of water purification plants.

HETCH HETCHY, ITS ORIGIN AND HISTORY. By M. M. O'Shaughnessy. Newbegin's Book Shop, 358 Post St., San Francisco, Calif., 134 pp., maps, tables, diagrs., 12 × 9 in., cloth, $5.

This is a straightforward account of the Hetch Hetchy project for supplying water to San Francisco, from its inception in 1901 to its completion in 1934. The actual construction, from 1912 to 1934, was directed by Mr. O'Shaughnessy, who reviews the progress of the work and the methods by which it was financed. The book was published in a small edition, of which 300 copies are for sale.

THE HOUSE OF HEALTH—HOW TO BUILD IT. By O. Albert. East Orange, N.J., Opla Company (P. O. Box 66), 1935. 80 pp., illus., tables, 11 × 9 in., paper, $1.

This pamphlet is intended to assist the prospective housebuilder by providing reliable information on the construction and equipment of fireproof dwellings, in readable, non-technical language. The author first presents a number of typical designs by various architects. Following this, he discusses types of construction, materials, heating, and equipment, describing various ways of meeting the usual problems. Cost data are used freely.

MANUAL OF ENGINEERING DRAWING FOR STUDENTS AND DRAFTSMEN. By T. E. French. 8 ed. New York and London, McGraw-Hill Book Co., 1935. 481 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.

A college textbook on architectural and map drawing and on numerous allied topics. This edition has been enlarged by a new chapter on sections and conventions, and new material on dimensioning. It has also been made to conform to the standards of the American Standards Association. A useful bibliography of allied subjects is included.

MUNICIPAL YEAR BOOK, 1935. Editors, Clarence E. Ridley and Orin F. Nolting. Chicago, International City Managers' Association (850 East 58th Street), 1935. 392 pp., tables, 10 × 7 in., cloth, $4.

This volume contains important data on all of the 960 cities of over 10,000 population in the United States. More than a hundred pages are devoted to a résumé of significant events and developments in the various fields of municipal administration in 1934, each summary being prepared by an outstanding authority. New sections included this year consist of one on local government units; data on the 96 metropolitan districts in the United States; activities and services of state municipal leagues; municipal personnel and retirement data.

OBSERVATION AND RECORD OF PRESSURES BELOW WORKS ON PERMEABLE FOUNDATIONS. (Central Board of Irrigation, Publication No. 8.) By A. N. Khosla. Simla, India, Central Board of Irrigation, 1934. 19 pp., diagrs., charts, tables, 13 × 8 in., paper, apply.

Mr. Khosla has been closely associated with the practical investigation of the flow of waters beneath weirs and dams founded on permeable soils, and the pressures resulting from the flow. This report describes the methods of making observations on full-scale works which he has devised, and the precautions to be observed. The report indicates general lines for the location and erection of pressure pipes, describes the instruments used, and discusses the recording and analysis of the pressures.

PILES AND PILE DRIVING. By A. C. Dean. London, Crosby Lockwood & Son, 1935. 221 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 42 s.

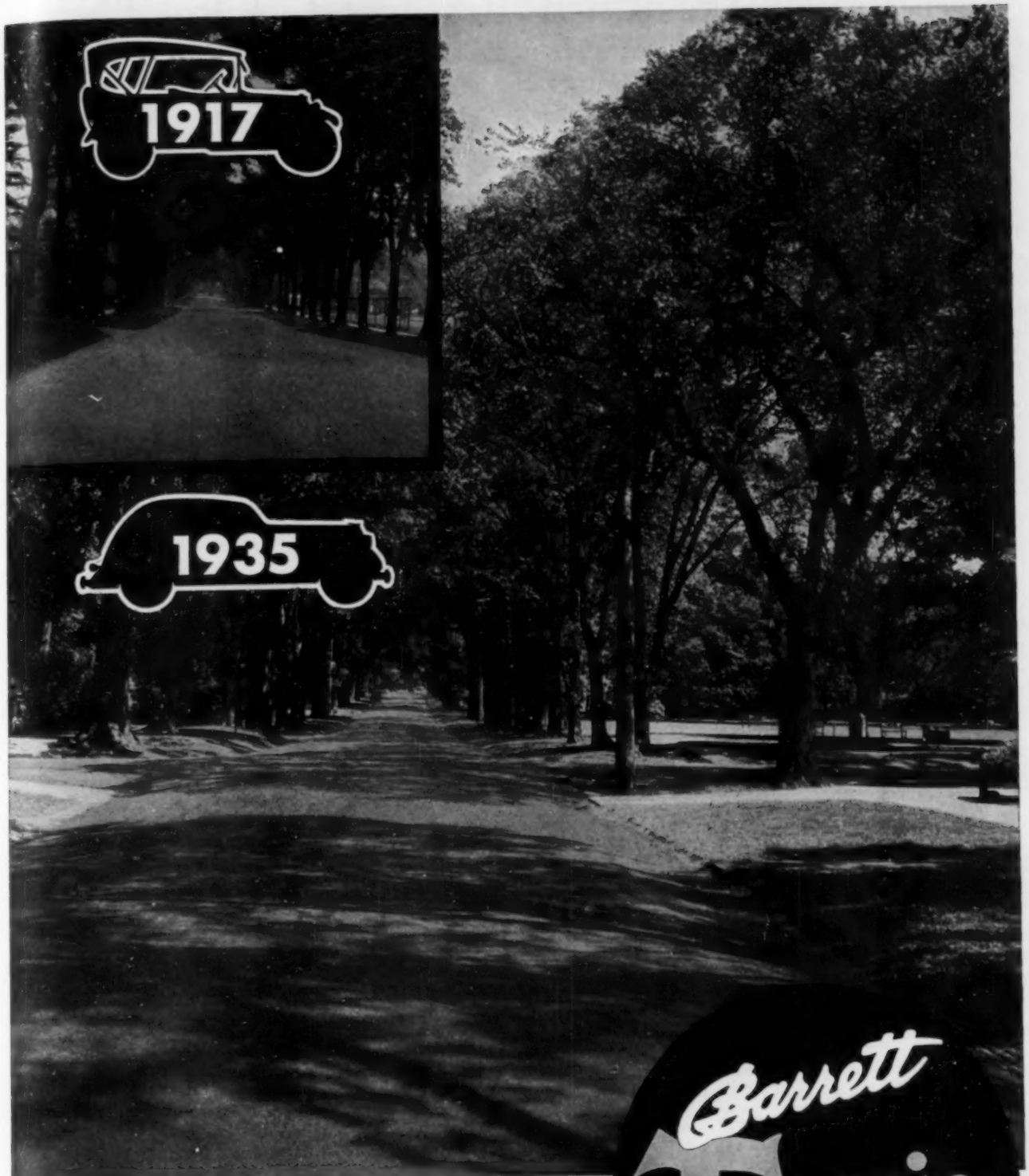
A comprehensive, practical work on the subject. The author discusses timber, reinforced concrete and steel piles, sheet piles, and disk and screw piles, giving special attention to forms in use currently. Pile driving is also considered, and much space is given to the theoretical carrying capacity of piles and the stability of walls and cofferdams. An appendix describes some timbers used in piling work and gives useful tables of stresses, angles of repose, etc.

PUBLIC LIBRARY BUILDINGS, Their Financing, Design, Construction, Equipment and Operation. By D. Q. McComb. Publ. by Mary O. McComb, 2901 South Hobart Blvd., Los Angeles, Calif., 1935. 325 pp., illus., diagrs., tables, 11 × 8 in., cloth, $5.

This book discusses the erection and maintenance of small and medium-sized library buildings in a thoroughly practical manner, covering all questions from their financing to their daily care. There are photographs and floor plans of eighteen branch library buildings of various sizes, and typical specifications for library buildings and equipment.

STONE INDUSTRIES, DIMENSION STONE, CRUSHED STONE, GEOLOGY, TECHNOLOGY, DISTRIBUTION, UTILIZATION. By O. Bowles. New York and London, McGraw-Hill Book Co., 1934. 519 pp., illus., diagrs., maps, tables, 9 × 6 in., cloth, $5.

This work fills a decided gap in technical literature by providing a comprehensive account of the stone industry of this country in all of its ramifications. An introductory section discusses such general features as the extent and subdivision of the industry.



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CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

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BRIDGES

CRANES, LOCOMOTIVE, BOOMS. Splicing Locomotive Crane Boom to Handle 75-ft Sheetpiling. W. G. Cheever. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, p. 564. Lengthening crane booms with built-up sections of $2^1/_2$ by $2^1/_2$ by $^5/_{16}$-in. angles and 2 by 2 by $^5/_{16}$-in. lacing bars stiffened on top, bottom, and both sides by trussing cables and outriggers, used in construction of foundation cofferdams of vertical-lift railroad bridge over Cape Cod Canal.

DESIGN. Little Bay and Bellamy River Bridges, C. M. Spofford. *Boston Soc. Civ. Engrs.—Journal*, vol. 22, no. 1, Jan. 1935, pp. 1–21. Design and construction of two bridges near Portsmouth, N.H.; Little Bay Bridge is steel-truss structure, 1,528 ft long with maximum span of 275 ft; Bellamy River Bridge comprises trestle consisting of 20 spans of 30 ft each and draw span with clear opening of 40 ft; use of proving ring in measuring reactions of Little Bay Bridge.

FLOORS. Formules utiles pour le calcul des tabliers des ponts, A. Charrueau. *Technique des Travaux*, vol. 10, no. 8, Aug. 1934, pp. 507–511. Collection of useful formulas for design of bridge floors, largely based on theorem of five moments.

MOVABLE, ELECTRICAL CONTROL. Electric Drive for High-Speed Lift Bridge, C. P. Hamilton. *Ry. Elec. Engr.*, vol. 26, no. 5, May 1935, pp. 106–109 and 116. First of three vertical-lift bridges across the Passaic River at Newark, N.J., placed in service by the Pennsylvania Railroad, has 2,100-ton span which moves at rate of 2 ft per sec; 25-cycle, 11,000-v circuits are primary source of power; engineering provisions for complete freedom of train and boat movement.

RIGID FRAME. Rigid Frame Bridges in Grade Crossing Elimination, A. J. Boase. *Roads & Streets*, vol. 77, no. 8, Aug. 1934, pp. 298–300. Utilization of elastic properties of structure; estimating frame dimensions; characteristic features of rigid-frame bridge; adaptability of rigid-frame bridge to grade-crossing eliminations; variations of rigid-frame principle. Before 1934 Highway Conference.

STEEL. Steel Bridges. *Roads & Road Construction*, vol. 12, nos. 136 and 138, Apr. 2, 1934, pp. 106–107 and June 1, pp. 182–183. Apr. 2: Working stresses; corrosion; flame and arc welding; data for design. June 1: Brief review of principal types; engineering developments; suspension bridges; cantilever type; steel arches.

STEEL, TRESTLE. Reconstruction, Under Traffic, of Bridge on 12-Degree Curve Over 180-ft. Canyon, Canadian Pacific Railway. *Can. Ry. & Mar. World*, no. 445, Mar. 1935, pp. 93–94. Bridge replacement carried out by Canadian Pacific on Carmi Subdivision, British Columbia District; new steel trestle bridge consists of five steel towers of 45-ft spans, one concrete pier at east approach, and concrete abutment at each end; illustration of original timber trestle given.

STEEL TRUSS. New Richmond Street Highway Bridge at London, Ont., J. R. Rostron. *Can. Engr.*, vol. 67, no. 6, Aug. 7, 1934, pp. 3–6 and 10. Old steel-truss traction bridge rebuilt and placed on new site over south branch of River Thames, facilitating traffic with South London; structure has 160-ft span, 22-ft roadway, and two 5-ft sidewalks.

SUSPENSION. Steel Bridges. *Roads & Road Construction*, vol. 12, nos. 142 and 144, Oct. 1, 1934, pp. 352–354, and Dec. 1, pp. 420–422. Oct. 1: Compilations of data from recent engineering literature on suspension bridges of spans exceeding 1,000 ft; theory and design; model experiments. Dec. 1: Suspension bridges of spans less than 1,000 ft; wire cable suspension bridges; wire cable spans not exceeding 500 ft; eyebar chain bridges; welded-links chain bridges; bastard type.

SUSPENSION, DESIGN. Suspension Bridges with Continuous Stiffening Truss, S. Timoshenko and S. Way. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 452–466. Formulas for calculating stresses and change of shape in suspension bridges with continuous stiffening girders derived from differential equation of sag of cable, change in which, caused by live load, must be equal to deflection of stiffening girder, assuming that length of suspension rods remains unchanged; numerical tables and examples. (Brief abstracts in French and German.)

SUSPENSION, NEW YORK CITY. Aluminum Trusses and Floor for Brooklyn Bridge. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, pp. 547–560. Proposed plan for reconstruction of famous suspension bridge contemplates new suspended structure, providing 12 lanes for vehicular traffic on two decks without increasing present dead loads; existing towers, cables, and anchorages to be retained.

BUILDINGS

AIR CONDITIONING. Refrigeration as Applied to Air Conditioning and Cooling by Direct Radiation in Rooms, J. C. Musgrave. *Brit Assn. Refrig.—Proc.*, vol. 31, no. 1, 1934–1935, pp. 97–103 (discussion), 103–106, 3 supp. plates. Principles of air conditioning as applied to theaters, restaurants, etc.; panel heating of buildings.

APARTMENT HOUSES, DESIGN. Apartment House Planning Requirements Including Basic Dimensions. *Arch. Rec.*, vol. 77, no. 3, Mar. 1935, pp. 169–181. Check list of requirements for apartment house planning; essentials of plan arrangement and equipment; neighborhood location; orientation; building design; typical defects of exterior design; interiors; temperature and humidity; floors; cellarless apartments; kitchen; bathroom; closets; stairway; landscaping; noise and its prevention; control of vermin; space requirements for children's playground.

RAILROAD STATIONS, FRANCE. Le nouveau hall de la gare de Rheims, G. Le Marec. *Technique des Travaux*, vol. 10, no. 10, Oct. 1934, pp. 603–612. Design and construction of new railroad station of Rheims, France, including glass-covered roof 65 m by 106 m, made up of two parallel series of reinforced concrete arches, 29 m and 35 m in span, spaced from 4.1 to 4.9 m apart and having width of 1.2 m; details of arch ribs, columns, sheds, etc.

WATERPROOFING. Waterproofing and Dampproofing. T. S. Rogers. *Am. Architect*, vol. 146, no. 2632, Apr. 1935, pp. 66–85. Waterproofing new construction; membrane method; special cements and admixtures; impermeable concrete; iron method; constructing weather-resisting masonry walls; mortar joints; bituminous dampproofings; flashings; remedial waterproofing methods. Bibliography.

WOODEN. New Building Demonstrates Modern Wood Construction, L. V. Teesdale. *Eng. News-Rec.*, vol. 114, no. 15, Apr. 11, 1935, pp. 525–527. Design and construction of two buildings of U. S. Forest Products Laboratory, Madison, Wis.; one is storage and testing unit 160 ft long, 46 ft wide, 12 to 19 ft high, and other is garage 64 by 24 ft, with roof height of from 12 to 14 ft; plywood used for finish on outside walls, etc., incorporating built-up arches, some glued and some of solid timbers with dowel connectors.

WOODEN, CONSTRUCTION. How to "Shrink-Proof" Wood Construction, F. R. Walker. *Am. Bldr.*, vol. 57, no. 3, Mar. 1935, pp. 64–65. Outline of new and inexpensive method of "shrink-proof" construction using light pressed steel members to support and reinforce wood framing at vulnerable points; methods of attaching metal "shrink-proof" joist supports; methods of nailing wood base shoe.

CITY AND REGIONAL PLANNING

IDEAL COMMUNITY. Broadacre City: New Community Plan, F. L. Wright. *Arch. Rec.*, vol. 77, no. 4, Apr. 1935, pp. 243–254. Author's conception of ideal community—"general decentralization and architectural reintegration of all units into one fabric"; coordinated grouping of small farms, factories, homes, schools, and laboratories.

UNITED STATES. Geography and National Land Planning, W. L. G. Joerg. *Geographical Rev.*, vol. 25, no. 2, Apr. 1935, pp. 177–208; 1 supp. sheet. Research advocated by Science Advisory Board; climatic risks; soil erosion; survey of soil productivity; recommendations of National Resources Board; agencies concerned with land use.

ZONING. Report of Committee on City Planning and Zoning. *Nat. Fire Protection Assn.—Advance Paper*, mtg., May 13 to 16, 1935, 6 pp. Supplement to brochure on "City Planning and Zoning in Relation to Fire Prevention and Fire Protection."

ZONING, WISCONSIN. County Zoning Progress in Wisconsin, W. A. Rowlands. *Am. City*, vol. 50, no. 1, Jan. 1935, pp. 49–50. Relation between state and county agencies; need for careful study of conditions preceding zoning; home rule features of Wisconsin zoning law; creating enlightened public opinion. Before Nat. Conference on City Planning.

CONCRETE

CEMENT-ASBESTOS. Applications nouvelles de l'amiante-ciment, R. Pascal. *Technique des Travaux*, vol. 10, no. 8, Aug. 1934, pp. 497–506. New applications of asbestos cement; distribution of stresses in asbestos-cement concrete; results of tests with special reference to test of concrete columns encased in tubes of asbestos cement, also tests of pre-cast vaults less than 1 in. thick; use of asbestos-cement concrete in construction of sheds.

CEMENT, HYDRATION. Hydration and Strength of Cement and Concrete, A. J. Eiger. *Cement and Cement Manufacture*, vol. 7, no. 8, Aug. 1934, pp. 231–243. Determination of rate of hydration of three types of cements; derivation of formulas.

CONSTRUCTION, VIBRATIONS. Le béton vibré on pervibré, ses propriétés et conditions d'emploi, J. Bolomey. *Technique des Travaux*, vol. 10, no. 9, Sept. 1934, pp. 555–558. Review of tests of, and experience with, vibrated concrete and economy of its use in construction.

DESIGN. Schubwiderstand und Schubsicherung im Eisenbeton, H. Ertl. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 145–166. Theoretical and experimental study of shear resistance of concrete members and of methods of reinforcing concrete against shear; slope of mean tension and compression forces in homogeneous beam; truss effect of stirrups in cracked concrete; probable distribution of transverse stresses in neutral axis of beam uniformly loaded. (Brief abstracts in French and English.)

DESIGN, BENDING. Designing Concrete Members for Bending and Compression, F. E. Turneaure. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, p. 566. Outline of trial method of analysis of unsymmetrically reinforced concrete members subjected to bending and compression, with tension on one side of section; illustrative examples.

MIXING. Case Against Surface Area and Fineness Modulus, F. S. Besson. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, pp. 248–249. Original experiments leading to conclusion that arbitrary weighting of particle sizes gives no exact measurement of cements and concrete aggregates.

Mississippi Lock No. 5A, Winona, Minn. 1500 tons of Inland Section I-31 used for permanent cut-off walls; 1200 tons Inland Section I-22 for temporary cofferdam. Project also involved 360 tons of Inland Reinforcing Bars.

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CONSTRUCTION INDUSTRY

COSTS. Current Construction Unit Prices. *Eng. News-Rec.*, vol. 114, no. 15, Apr. 11, 1935, pp. 540–541. Tabulation of unit costs bid on contracts for construction of pile dikes and revetments in following: Missouri River; Hetch Hetchy reservoir extension; highway bridge at Ebey Slough, Wash.; and San Francisco Bay pipe line crossing.

DAMS

EROSION. Protection Against Scour Below Overfall Dams, E. W. Lane and W. F. Bingham. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, pp. 373–378. Conditions determining form of spillway and type of apron required to protect river bottom against scour; need for model study emphasized and possibilities for savings therefrom; changes in dam-crest length; use of crest gates; tailwater rating curves.

HYDRAULIC FILL, MONTANA. Glimpses of Colossal "New Deal" Project. *Earth Mover*, vol. 22, no. 2, Feb. 1935, pp. 13–17. Construction of largest earth dam in world rising 242 ft above bed of Missouri River, which will contain 100,000,000 cu yd of hydraulic fill and, with auxiliary embankments, will have total length of 4 miles.

UPLIFT PRESSURE. Hydrostatic Uplift Pressures Under Dams on Pervious Earth Foundations, D. J. Herbert. *U. S. Bur. Reclamation—Tech. Memo.*, no. 384, May 25, 1934, 14 pp., 59 supp. sheets. Comparative discussion of theories and methods of determining uplift pressures under masonry dams on pervious foundations, with special reference to proposed theory of electric analysis.

FLOW OF FLUIDS

WEIRS, BROAD-CRESTED. Flow Over Rounded Crests—New Formula Offered, J. U. Doland. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, p. 551. Modified and simplified formulas of computation of discharge of rounded crest dams and weirs based on unpublished data furnished by the U. S. Bureau of Reclamation.

FOUNDATIONS

BOSTON, MASS. Parcel Post Building, Boston, Mass. *Boston Soc. Civ. Engrs.—Journal*, vol. 22, no. 1, Jan. 1935, pp. 22–48. Symposium on testing and construction of deep foundations, including following papers: Foundations of Boston, Mass., Parcel Post Building, H. E. Sawtell; Preparation and Approval of Plans and Contract, C. R. Main; Superstructure of Parcel Post Building, A. Haigh; Interesting Sidelights on Construction of Parcel Post Building Foundations, E. F. McGee.

BRIDGE PIERS, CONSTRUCTION. Difficult Caisson Problems Overcome in Sinking Deep Piers—II, C. H. Purcell, C. E. Andrew, and G. B. Woodruff. *Eng. News-Rec.*, vol. 114, no. 8, Feb. 21, 1935, pp. 278–281. Conclusion of article describing work on foundations for San Francisco–Oakland Bay Bridge; experiences with individual caissons, with comments on design and lessons learned in sinking; cleaning bottoms and sealing.

COFFERDAMS, WATERPROOFING. Sur un procédé d'étanchéité de batardeaux ou de barrages, G. Menier. *Académie des Sciences—C.R.*, vol. 199, no. 20, Nov. 12, 1934, pp. 1041–1044; see also *Génie Civil*, vol. 105, no. 22, Dec. 1, 1934, pp. 511–512. Practical experience with moleskin sheets used for waterproofing of cofferdams and needle dams; tests of resistance of moleskin to tearing and rupture by water pressure.

CONCRETE. Pumped Concrete for Power House Foundations, R. Hammond. *Steam Engr.*, vol. 4, no. 7, Apr. 1935, pp. 277–279. Description of method of placing concrete in building and foundation work, and its peculiar advantages for work undertaken in connection with power stations and boiler houses; plant itself is simple and consists of single-acting force pump, drawing of which is shown.

PILES, WOODEN, PRESERVATION. Resistance of Creosoted Piles to Borer Attack in Tidewater, H. von Schrenk. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, p. 383. Abstract of paper leading to conclusion that timber with wide sapwood ring, proper air seasoning, maximum impregnation with oil and careful handling, ensures long service; historic review; types of creosote; records of use. Before Am. Wood Preservers' Assn.

HYDRAULIC ENGINEERING

CAVITATION. Cavitation Research, J. C. Hunsaker. *Mech. Eng.*, vol. 57, no. 4, Apr. 1935, pp. 211–216. Fundamental study of hydraulic cavitation, sponsored by Safe Harbor Water Power Corp., in progress in hydraulic laboratory of Massachusetts Institute of Technology during last 2 years; objective of research was to determine mechanism by which hydraulic cavitation damages boundary walls; progress report on work. Bibliography.

HYDRODYNAMICS. Theoretical Determination of Lift Coefficient for Thin Elliptic Cylinder, L. Howarth. *Roy. Soc.—Proc. Series A*, vol. 149, no. 868, Apr. 10, 1935, pp. 558–586. Calculation of lift coefficient of infinitely long, thin elliptic cylinder in viscous fluid moving with constant velocity at infinity, in direction inclined to major axis; criterion for determining circulation; irrotational flow past cylinder; laminar and fully turbulent boundary layer; case when both laminar and turbulent portions are present in boundary layer.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

METALS, CORROSION, SEAWATER. Sur les essais accélérés de corrosion par l'eau de mer, E. Drouilly. *Aciers Spéciaux, Métaux & Alliages*, vol. 9, no. 110, Oct. 1934, pp. 490–492. Accelerated corrosion tests by seawater; general considerations; different categories of tests; conclusions.

INLAND WATERWAYS

CANAL LOCKS, CONSTRUCTION. Concreting Plant and Methods on Mississippi River Locks, J. B. Alexander and S. Comess. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, pp. 543–546. Review of plant and procedure employed and summary of progress and performance in mixing and placing 615,000 cu yd of concrete in seven locks in Rock Island Engineer District; production rates in concreting locks and dam.

MATERIALS TESTING

CONCRETE. Mass Concrete Tests in Large Cylinders, R. F. Blanks and C. C. McNamara. *Am. Concrete Inst.—Journal*, vol. 6, no. 3, Jan.-Feb. 1935, pp. 280–303. Mass concrete research by Bureau of Reclamation in connection with design and construction of Boulder Dam, including tests in cylinders varying in size from 2 × 4 to 36 × 72 in.; effect of size of test specimen; limiting value for ratio of diameter of cylinder to maximum size of aggregate; effect of maximum size of aggregate, wet-screening, and curing condition. Bibliography.

CONCRETE TESTING. Compression Test of Concrete by Small Testpieces—I, Y. Sanada. *Soc. Chem. Industry, Japan—Journal*, vol. 37, no. 9, Sept. 1934, pp. 1203–1207; see also English abstract in supp. binding of same issue, pp. 542B–544B. Comparison of compression of small and common-mold concrete, using same aggregates.

SEWERS, LINING. Sewer-Lining Materials Tested for Corrosion Resistance, H. G. Smith. *Eng. News-Rec.*, vol. 114, no. 13, Mar. 28, 1935, pp. 444–445. Los Angeles Bureau of Engineering tests of many materials for use as protection against septic sewage gases; molten sulfur silicate gives promising results.

WOOD PRESERVATION, RAILROADS. Report of Committee XVII—Wood Preservation. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 373, Jan. 1935, pp. 453–518, 1 supp. plate. Records of service tests for treated ties; piling used for marine construction; destruction by termites and possible ways of prevention; incising of all forest-products material; investigations being made for determination of toxicity value of creosote and creosote mixtures.

PORTS AND MARITIME STRUCTURES

DUNKIRK. New Harbor Works at Dunkirk. *Engineer*, vol. 159, nos. 4131 and 4132, Mar. 15, 1935, pp. 279–281, and Mar. 22, pp. 294–297 and 304. Program includes: new outer harbor and deep-water entrance; embarkation mole in tidal harbor for passenger traffic; new entrance lock; floating dock with lifting capacity of 20,000 tons; construction of new canal to provide for inland waterway drainage; illustrated description.

PIERS, WELDING. Constructing All-Welded Ocean Pier. *Welding Engr.*, vol. 20, no. 1, Jan. 1, 1935, pp. 22–23. Five miles of welded joints used in erecting steel framework of new 2,327-ft pier completed on California sea coast at Davenport; in order to provide structure that would withstand constant battering of waves, not a bolt or rivet was used; all connections made by welding.

SEAWALLS, VENEZUELA. New Type Seawall Built for Subsiding Lake Shore in Venezuela, J. J. Collins. *Eng. News-Rec.*, vol. 114, no. 12, Mar. 21, 1935, pp. 405–408. Design and construction of continuous wall of precast reinforced concrete sheetpiles, 14,731 ft long, about 30 ft high, rendered watertight by cement grouting, tied together by heavily reinforced stringer beam and supported by inclined composite concrete and wood anchor piles; wall protects oil fields of Lake Maracaibo; barge-casting yard, special driving rigs.

SHORE PROTECTION. Beach-Protection Work on California Coast Roads. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, pp. 253–254. Description of groins and seawalls of various types used extensively along Pacific coast, north of Los Angeles; details of construction of low-cost, steel-and-timber seawall along highway north of Ventura; groins hold and build beaches.

ROADS AND STREETS

CONCRETE. Dowels and Joint Fillers for Concrete Pavements, R. E. Toms. *Eng. News-Rec.*, vol. 114, no. 9, Feb. 28, 1935, pp. 318–319. Data and opinions on dowels used to transfer vehicle loads across joints in concrete pavement slabs; effect of dowel spacing on slab stresses at joints; dowel installation; appraisal of joint fillers; cost of adequate pavement jointing.

CONNECTICUT. Paralleling Boston Post Road with Superhighway, E. F. Verplanck. *Eng. News-Rec.*, vol. 114, no. 11, Mar. 14, 1935, pp. 386–388. Beginning of work on 38 miles of new 4-lane road planned to parallel Boston Post Road; 300-ft right-of-way is being taken to permit doubling 4-lane road; grading methods; bridges and culverts.

DESIGN. Field Notes on Road Design. *Roads & Road Construction*, vol. 12, nos. 139, 140, 143, and 144, July 2, 1934, pp. 204–205; Aug. 1, pp. 244–245; Nov. 1, pp. 368–369; and Dec. 1, pp. 404–405. Earthworks; limiting heights of embankments; consolidation of banks; slopes of batters; preparation of subtrade; shaping in cuttings; mechanical shaping; supporting power of subtrade; consolidation; use of subgrade for traffic; shaping on embankments; cutting out soft places; subsoil drainage; effect of subsoil drainage; character of clay; movement of water in clay; determination of site.

EARTH. Soil Road Surfaces, C. A. Hogentogler. *Pub. Roads*, vol. 15, no. 12, Feb. 1935, pp. 273–286. Application of research in soil mechanics to design and construction of dirt roads; factors influencing road and soil stability; plasticity tests indicating capillarity and cohesion; deliquescent substances used to prevent excessive loss of moisture in dry weather; chemical treatment used to produce high soil density; permanent densification of soils; application of surface chemistry to soil stabilization.

INDIANA. New Indiana Pavement Construction Has Asphalt Center Strip with Concrete Sides. *Roads & Streets*, vol. 77, no. 11, Nov. 1934, pp. 403–404. 20-ft strip of asphalt with 10 ft of concrete on each side is design adopted for pavement of Ridge Road for distance of 3.83 miles westward from Gary, Ind.; asphalt base course; asphalt top course.

HIGHWAY ENGINEERING, CONSTRUCTION. Seventh International Road Congress. *Roads & Road Construction*, vol. 12, no. 141, Sept. 1, 1934, pp. 289–305. Abstracts of papers and discussions on progress made since congress held in Washington in 1930, in use of cement for construction of roadways; progress made since 1930 in preparation and use of tar, bitumen, and emulsions for construction and maintenance under most economical conditions of road surfaces, whether in built-up areas or open country.

HIGHWAY ENGINEERING, SAFETY. Seventh International Road Congress. *Roads & Road Construction*, vol. 12, no. 142, Oct. 1, 1934, pp. 330–341. Abstracts of papers and discussions on progress made in construction and maintenance of highways; means adopted for promoting safety of traffic; analysis of relationship between vehicular traffic and road surfaces, from weights of vehicles and their dimensions.

HIGHWAY SYSTEMS, SOVIET UNION. Road Construction in R.S.F.S.R. *Roads & Road Construction*, vol. 12, no. 141, Sept. 1, 1934, p. 280. Statistical data on highway system in U. S. S. R.; construction progress.

HIGHWAY TRAFFIC SIGNS, SIGNALS AND MARKINGS. Safety Markers on Poles Indicate Road Margins. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, pp. 257. Description of safety markers adopted on California highway, consisting of thin metal plates about 5 by 12 in. in size, sprayed with aluminum paint and tacked to poles in irregular position so as to give outline as irregular as possible.

MAINTENANCE AND REPAIR. Bituminous Mat Surfaces for City Streets, C. H. Bryson. *Roads & Streets*, vol. 77, no. 9, Sept. 1934, pp. 336–337. Method of laying of 317,364 sq yd of bituminous mat surfacing 1 in. in thickness on streets of Colorado Springs, Colo.; progress, equipment, and cost data. Before 1934 Highway Convention at University of Colorado.

MAINTENANCE AND REPAIR COSTS. Pavement Maintenance: Methods and Costs at Ann Arbor Mich., G. H. Sandenburgh. *Roads & Streets*, vol. 77, no. 12, Dec. 1934, pp. 443–446. Engineering and cost data on bituminous resurfacing of old pavement; surface treatment with tar; equipment; methods of construction; cost of surface treatment; life of treatment; low cost bituminous pavements; method of construction; costs; quantities. Before Am. Soc. Mun. Engrs.

MAINTENANCE AND REPAIR, MILWAUKEE. Mud-Jacking System of Levelling Roadway Slabs. *Engineering*, vol. 139, no. 3606, Feb. 22, 1935, pp. 196 and 202. System that has come into extensive use in United States; machines employed are known as mud-jacks and are manufactured by National Equipment Corporation, Milwaukee; process consists of forcing pasty mixture of earth, portland cement, and water under depressed concrete slab.

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MAINTENANCE AND REPAIR, RESURFACING. Methods of Resurfacing Streets in Indianapolis, Ind., M. G. Johnson. *Roads & Streets*, vol. 77, no. 10, Oct. 1934, pp. 360–361. Use of concrete for resurfacing; central-mix or job-mix concrete; high-early-strength cement; winter construction; marketing concrete on quality basis. Before Congress on Pub. Works and Mun. Eng.

RAILROAD CROSSINGS, FINANCING. More Money for Grade Separation. *Ry. Age.*, vol. 98, no. 10, Mar. 9, 1935, pp. 352–355. How popularity and success of program for federal financing of grade separation point to prospects for additional appropriation.

ROAD MATERIALS, AGGREGATES. What Is Known of Aggregates for Road Surfaces? F. H. Jackson. *Eng. News-Rec.*, vol. 114, no. 10, Mar. 7, 1935, pp. 349–353. Interview on rôle of aggregate in paving mixtures, adequacy of abrasion and toughness tests, apparatus for testing aggregate quality, determination of stability of aggregate-bitumen mixture, mix-in-place and road-mix surfacing mixtures, study of durability, soundness, effect of aggregates on strength and volume change of concrete, etc.

SEWERAGE AND SEWAGE DISPOSAL

ACID. Gegenwaertiger Stand der Frage "Reinigung und Beseitigung saeurehaltiger Abwaesser," H. Stooff. *Gesundheits-Ingenieur*, vol. 57, no. 52, Dec. 29, 1934, pp. 698–702. General review of present status of problem of treatment and disposal of acid sewage. Before German Soc. of Construction Engrs.

CHEMICAL PROCESS. Shades Valley Chemical Precipitation Plant at Birmingham, Alabama, H. H. Hendon. *Water Works and Sewerage*, vol. 82, no. 3, Mar. 1935, pp. 69–76. Comparative study of costs and operation of Ensley and Shades Valley plants leading to conclusion that chemical precipitation and chlorination of sewage, using iron salt as coagulant, gives results approaching those from trickling filters or activated sludge process; costs are less than two-thirds that of activated sludge plant. Before N.Y. State Sewage Works Assn.

COAL MINES AND MINING, STREAM POLLUTION. Die Abwaesser der Kohlenindustrie. Pruess. *Gesundheits-Ingenieur*, vol. 57, nos. 50 and 51, Dec. 15, 1934, pp. 672–676, and Dec. 22, pp. 687–690. Review of German practice of coal-mine drainage and of methods of treatment of sludge from coal preparation plants, with special reference to Ems district.

NEW YORK. Meeting of N.Y. State Sewage Works Association. *Water Works & Sewerage*, vol. 82, no. 2, Feb. 1935, pp. 61–66. Proceedings of 1935 annual meeting, including abstracts of following papers: Some Comments on Sewage Treatment Problems and Trends, C. G. Hyde; Disposal of Sewage Solids by Incineration, A. E. Stilson; Shades Valley Chemical Precipitation Plant at Birmingham, Ala., H. H. Hendon; Sewage Plant Laboratories, W. Donaldson; Centrifugal Dewatering of Sewage Sludges, J. S. Pecker; Colorimetric Method for Determining Dissolved Oxygen, M. L. Isaacs; and Features of Plainfield (N.J.) Sewage Treatment Works, J. R. Downes.

PIPE, VITRIFIED CLAY, DE-AIRING. Production of De-Aired Sewer Pipe, J. O. Everhart. *Brick and Clay*, vol. 86, no. 1, Jan. 1935, pp. 24–26. Review of problems met in special investigation; new ideas in manufacture considered; de-airing improves general qualities of sewer pipe.

PLANTS, CANAJOHARIE, N.Y. Waste Disposal Plant of Canajoharie, N.Y. PWA Project, H. W. Taylor. *Water Works & Sewerage*, vol. 82, no. 3, Mar. 1935, pp. 79–82. Description of plant combining 18-ton refuse incinerator and sewage sludge tank serving population of 3,000; heat interchange; sewage-treatment facilities; multiple effluent headers; air-insulated steel digestion tank; compactness of plant; incinerator performance; design adjustments.

PLANTS, GERMANY. Die Absetzanlage Wuppertal-Buchenhofen. *Mahr. Gesundheits-Ingenieur*, vol. 58, no. 2, Jan. 12, 1935, pp. 21–26. Buchenhofen sewage settling plant in Wupper Valley; sewage from region of 370,000 inhabitants with very heavy load of industrial sewage, mostly from textile industries, is received by stream affording dilution of only 1:2 to 1:4; treatment is primarily by settling.

PLANTS, GREAT BRITAIN. Ilford and Barking Joint Sewerage Scheme. *Engineer*, vol. 159, no. 4136, Apr. 19, 1935, pp. 409–410 and 412; see also *Engineering*, vol. 139, no. 3613, Apr. 12, 1935, pp. 386–387 and 390. Illustrated description of new joint pumping station and works, including sewers, pumps, pumping mains, etc.

SEWERS, EXPLOSIONS. Ueber die Ursache von Kanalvergasungen, K. Dau. *Gesundheits-Ingenieur*, vol. 57, no. 7, Feb. 17, 1934, pp. 80–82; see also *Sewage Works Journal*, vol. 6, no. 4, July 1934, pp. 828–829. Causes of sewer gasification; results of questionnaire survey on explosions and poisoning from sewer gas; analysis of replies received from 43 largest German cities; prevention of formation of explosive mixtures in sewers.

STRUCTURAL ENGINEERING

BEAMS, CONCRETE. Compression Testing of Concrete Beams from Flexure Tests. *Roads & Streets*, vol. 77, no. 9, Sept. 1934, pp. 328–330. Method of preparing compression testing samples from fragments of concrete beams tested for bending in field; photo-elastic analysis of modified cube method.

CHIMNEYS, DESIGN. Die Berechnung zylindrischer, biegungssteifer Schalen unter beliebigem Lastangriff, E. Gruber. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 196–205. Theoretical discussion of principles of design of thin wall chimney shells and similar structures, showing that distribution of normal stresses is curvilinear and depends on way in which load acts; bending moments due to deformation of annular cross sections are great and must be taken into consideration; formulas for chimney rigidly fixed at bottom. (Brief abstracts in French and English.)

COAL MINES AND MINING, ROADWAY SUPPORTS. Entwicklung und Stand des Ausbaus von Hauptstrecken im Ruhrbergbau, K. Eisenmenger. *Glueckauf*, vol. 71, no. 1, Jan. 5, 1935, pp. 2–10; see also English abstract in *Colliery Guardian*, vol. 150, no. 3872, Mar. 15, 1935, pp. 484–485. Development and status of roadway supports in Ruhr coal mines; steel and composite (mixed) type of support outweighs ordinary timbered support; in roadways subjected to high pressures, resistance to bending, tension, shear, and torsion must be considered when judging suitability of supports.

FLOORS, SOUNDPROOFING. Der Schallschutz von Decken, G. Hofbauer. *Gesundheits - Ingenieur*, vol. 57, no. 42, Oct. 20, 1934, pp. 562–566. Principles of soundproofing of floors; apparatus for testing soundproofness of floors; results of tests. Bibliography.

FLOORS, SURFACING. Technology of Emulsions for Surfacing Floors, L. Kirschbraun. *Eng. News-Rec.*, vol. 114, no. 8, Feb. 21, 1935, pp. 276–278. Use of cement to produce definite set and, by chemical combination, remove substantial portion of water; tests of experimental mastic floors to determine least limit of hydration; penetrometer for testing set of aggregate and emulsion mixtures for floor covering.

FRAMED STRUCTURES, DESIGN. Sign Conventions for Bending Moments in Rigid Frames, R. Fleming. *Eng. News-Rec.*, vol. 114, no. 7, Feb. 14, 1935, pp. 257–258. Review of recent American literature on subject.

GIRDERS, STRESSES. Maximum Bending Moment and Shearing Force Diagrams for Moving Loads, P. L. Capper. *Engineering*, vol. 139, no. 3607, Mar. 1, 1935, pp. 219–221. Various methods of calculating maximum bending moments and shearing forces on girders, due to moving concentrated loads, discussed.

HOUSING, COSTS. Quick Way to Make Reliable Cost Estimates, A. C. Shire. *Am. Architect*, vol. 146, no. 2631, Mar. 1935, pp. 41–45. Outline of simple method used by estimators of Federal Housing Administration; estimating component parts; factors of structural elements; examples of determining costs.

MASONRY STRUCTURES, STRESSES. Measuring Existing Stresses in Masonry Structures, N. Davey. *Engineer*, vol. 159, no. 4137, Apr. 26, 1935, pp. 442–443. Method developed at Building Research Station; description of strain gage developed at station.

RIVETED JOINTS, WELDING. Zusammenwirken von Nietung und Schweissung und Spannungsverteilung in der Naht, Gaber. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 193–195. Report on tests made at Karlsruhe Institute of Technology showing why riveted steel structures can be strengthened by welding only if in heavily loaded condition. (Brief abstracts in French and English.)

WELDED STEEL STRUCTURES. Investigation of Welded Seat Angle Connections, I. Lyse and N. G. Schreiner. *Am. Welding Soc.—Journal*, vol. 14, no. 2, Feb. 1935, pp. (supp.) 1–15 (discussion) 24–26. Results of tests of 29 welded seat-angle test specimens and correlative tests of four full-sized beam-column connections; results of investigation show effect of thickness of angle, location of resultant reaction of beam, length of vertical leg of angle and strength of weld on strength of seat-angle connection; analysis of results is basis of recommendations for design of angles, welds, and beams.

WELDS, TESTING. Photo-elastic Study of Bending in Welded Seat Angle Connections, I. Lyse and D. M. Stewart. *Am. Welding Soc.—Journal*, vol. 14, no. 2, Feb. 1935, (supp.) pp. 16–20. Photo-elastic investigation of properties of welded seat angle connections undertaken at Fritz Engineering Laboratory of Lehigh University in conjunction with actual seat angle tests carried on in cooperation with Structural Steel Committee of American Bureau of Welding; notes on test specimens; photo-elastic method of analysis; variables studied; discussion of variables; stress distribution; conclusions.

TUNNELS

RAILROAD. Pennsylvania Builds Large Double-Track Tunnel at Baltimore. *Ry. Age*, vol. 98, no. 15, Apr. 13, 1935, pp. 572–577. Largest shield tunnel ever driven in mobile ground, 3,403 ft long, built in connection with extensive improvements that Pennsylvania Railroad has been making in Baltimore, Md., in conjunction with electrification of its line between New York and Washington, D.C.; details of main shield work; cut-and-cover work.

RAILROAD, CONSTRUCTION. Driving Difficult Tunnel in Soft Ground. *Eng. News-Rec.*, vol. 114, no. 15, Apr. 11, 1935, pp. 509–515. Construction of new double-track arch tunnel paralleling old Union tunnel of Pennsylvania Railroad in Baltimore, 3,400 ft long, having cast-iron lining built by roof shield running on concrete side walls previously built in small shield-driven drift tunnels; controlling glacial and stratified materials; pump handling of concrete.

WATER RESOURCES

GERMANY. Die Wasserwirtschaft des Harzes, F. Collorio. *Gas- u. Wasserfach*, vol. 77, nos. 42 and 43, Oct. 20, 1934, pp. 725–728, and Oct. 27, pp. 744–749 (discussion), 749–750. Survey of water resources of Hartz Mountains region of Germany since thirteenth century; relation of mining operations to utilization of water resources; review of modern water works and hydro-electric power developments of region, including their financial problems.

UNDERGROUND. Water Supplies from Underground Sources, J. D. Restler. *Roy. Soc. Arts—Journal*, vol. 83, no. 4,300, Apr. 19, 1935, pp. 499–508 (discussion), 509–513. Fundamental points that engineer must examine when commencing to deal with water-supply problems; attention drawn to some of difficulties and dangers to be guarded against.

WATER TREATMENT

ANALYSIS. Purpose of Water Examination—I, J. J. Hinnan, Jr. *Water Works Eng.*, vol. 87, no. 26, Dec. 26, 1934, pp. 1430–1433. Roman methods of detecting hard water; testing by means of red wine; investigations in eighteenth century; importance of nitrogen compounds; study of organic matters in water; presumptive test for bacteria; sole reliance on bacterial examination unwise; advantages of sanitary chemical examination; risk of applying numerical standards rigidly; six essential parts of sanitary examination.

COAGULATION. Elements of Coagulation, G. D. Nordom. *Water Works Eng.*, vol. 87, no. 23, Nov. 14, 1934, pp. 1264–1267. Coagulating chemicals; equipment for feeding chemicals; mixing; sedimentation; control of coagulation; coagulation at optimum point; effect of presence of other ions; coagulation test. Before Pa. Water Works Operators' Assn.

FILTRATION, MATERIALS, PLATES. Studies Made of Use of Porous Plates for Rapid Sand Filters. *Water Works Eng.*, vol. 87, no. 25, Dec. 12, 1934, p. 1373. Tests conducted with Providence, R.I., water supply to study behavior of plates, frequency of clogging, and methods of cleaning.

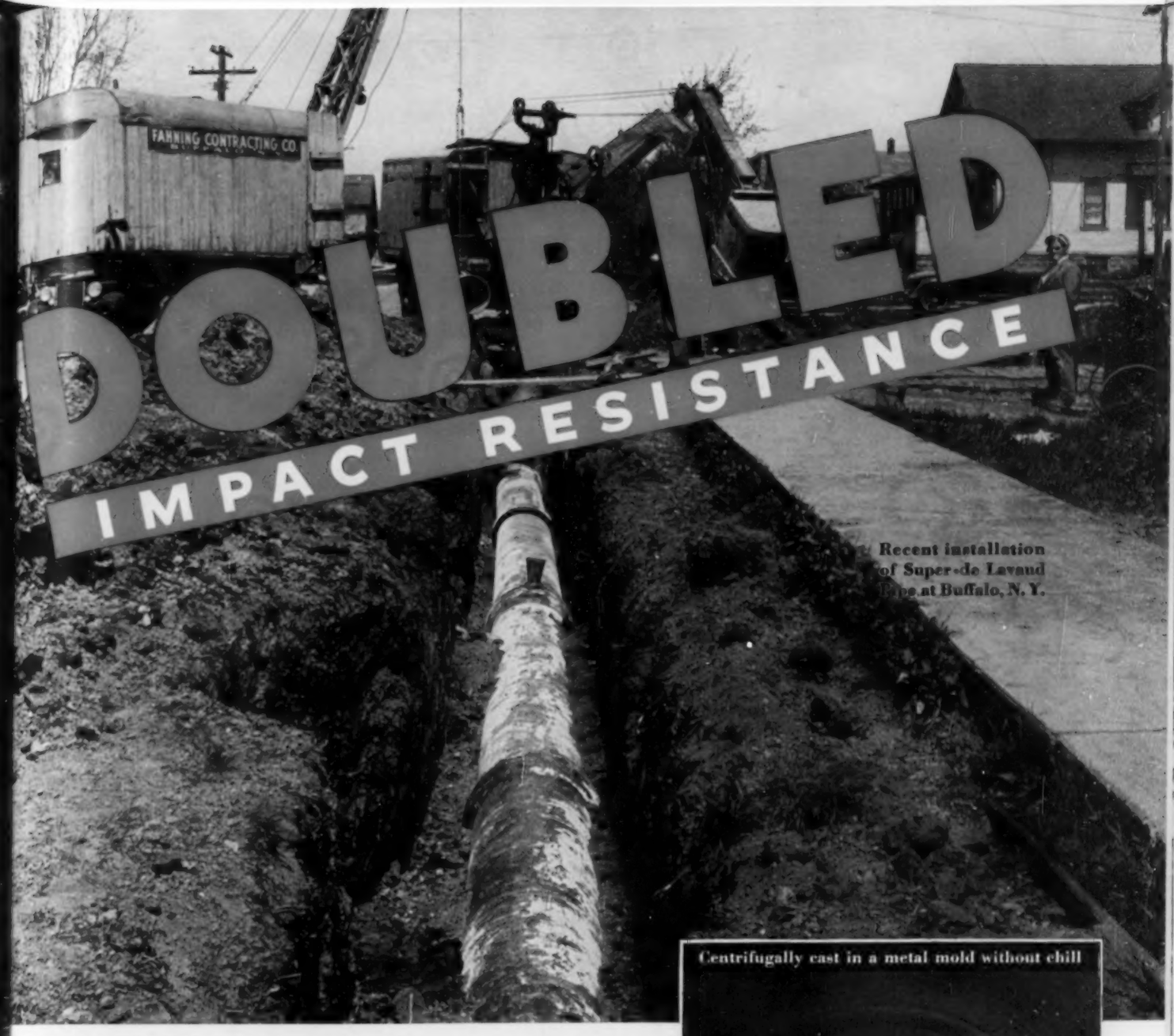
FILTRATION, MATERIALS, SAND. Cleaning Filter Sand. *Water Works Eng.*, vol. 87, no. 17, Aug. 22, 1934, pp. 929–930 and 933–934. Discussion by practical water-works superintendents of equipment and methods used; frequency of cleaning.

PLANTS, OSSINING, N.Y. Operating Results in Complete Water Treatment Plant, W. T. Miller and J. E. Kerslake. *Water Works Eng.*, vol. 87, no. 22, Oct. 31, 1934, pp. 1204–1207. Description of water treatment plant of Ossining, N.Y., serving population of 15,000, combining sedimentation, aeration, coagulation, filtration, iron, manganese, color and odor removal, and elimination of corrosion activity; operating costs; cost of odor removal. Before Am. Water Works Assn.

WATER WORKS ENGINEERING

INFILTRATION GALLERIES. Die wasserwirtschaftliche Bedeutung der kuenstlichen Anreicherung des Grundwassers unter besonderer Beruecksichtigung der Wasserwirtschaft Gross-Berlins, J. Denner. *Gas- u. Wasserfach*, vol. 77, nos. 24, 25, 26, and 27, June 16, 1934, pp. 413–415; June 23, pp. 429–433; June 30, pp. 444–447; and July 7, pp. 462–467. Review of German practice of replenishing underground water supplies with flood water or with stored water, with special reference to recommendations for improving water supply of greater Berlin. Bibliography.

WASTE SURVEYS. Wasted Water, H. E. Beckwith. *Water Works Eng.*, vol. 87, no. 26, Dec. 26, 1934, pp. 1427–1429. What waste does to system; economy of waste survey for gravity supply; effects of waste on pressure; large losses from underground leaks; unusual sources of waste. Before Pa. Water Works Operators' Assn.



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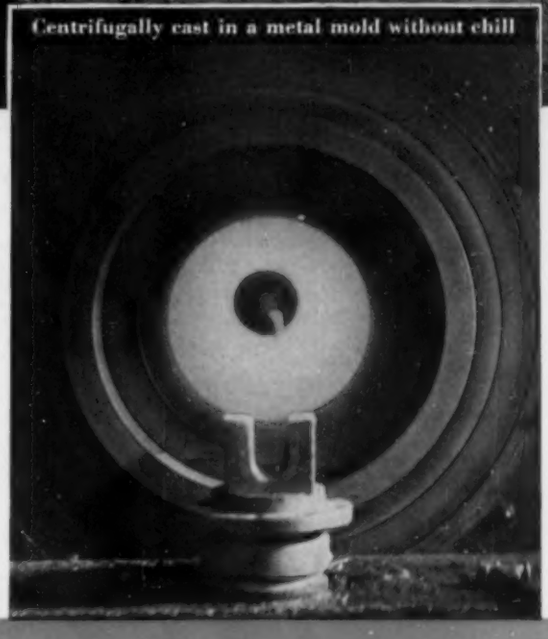

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JUNIOR

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; married; B.S. in C.E., University of Illinois; 6 months sales experience; 1½ years triangulation and hydrographic surveying; 2 years supervision and inspection of railway construction and maintenance. Desires valuation, appraising, engineering sales, survey or construction work. Location immaterial. Interviews solicited. D-4060.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 27; 2 years production manager and superintendent of food plant; design and location of equipment, chemical analysis, time studies, etc.; 3 years additional plant and sales work. Desirous of permanent connection and opportunity for responsible worker. Excellent references. Available immediately. D-4001.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; married; graduate of Rensselaer Polytechnic Institute, with degrees of C.E., 1931, M.C.E., 1933, and D.C.E., 1935; member of Sigma Xi. In graduate work majored in structural design and hydraulics; experience in municipal and highway surveying. Desires position as instructor in civil engineering or work in design or construction. Available immediately. Location preferred, eastern United States. D-3806.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 22; single; B.S. in C.E., New York University, 1934; majored in sanitary engineering; desires position as engineering apprentice or junior engineer in any branch of civil engineering, or as statistician. Location immaterial. Available immediately. D-3870.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 29; married; B.S. in C.E., Drexel Institute, 1932; 15 months railroad drafting room (survey, design, layout of commercial sidings); 1 year inspector on foundations and catenary (railroad electrification). Desires opportunity in any branch of civil engineering. Location secondary. D-4097.

GRADUATE CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Iowa State College, 1934; registered professional engineer, Minnesota and Iowa; 4 years experience as assistant to county engineer. Chief interests, highways, geodesy, municipal, and structures. Type of work and salary secondary. Available immediately. Location in Hawaiian or Philippine Islands desired. D-3689.

JUNIOR CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E. (cum laude), New York University, 1934; 5 months experience, mechanical drafting. Desires position in any field of civil engineering, preferably structural or highway, or with engineering periodical. Location and salary secondary. D-3775.

ENGINEER; Jun. Am. Soc. C.E.; recent graduate (B.S. in C.E.) Cooper Union Night School. Desires position in any field of civil engineering. Experienced in all forms of clerical work. Salary secondary. Location, preferably in New York City. D-3518.

ENGINEER; Jun. Am. Soc. C.E.; 23; married; B.S. in C.E.; majored, irrigation and drainage; 6 months office, field assistant, drainage, irrigation investigations; 1½ months assistant chief of party, U. S. Coast and Geodetic Survey; 1½ months assistant design, municipal water system; 3 months draftsman; 9 months junior topographic engineer, leveling and drafting. Desires position in any branch of civil engineering. D-4139.

GRADUATE CIVIL ENGINEER; student; B.S. in C.E., Georgia School of Technology, 1935; one year of experience in construction of oil refinery in South America. Best references. Desires position in any branch of civil engineering. Location immaterial. Available immediately. D-4119.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., Duke University, 1933. Majored, structural steel design and water supply 1 month with U. S. Coast and Geodetic Survey; 3 months experience, water and sewage works; 3 years as inspector of telephone apparatus. Desires opportunity in any branch of civil engineering. Location immaterial. Available. D-2683.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single, B.S. in C.E., Newark College of Engineering; 1½ years as draftsman; limited experience in surveying. Desires opportunity in any branch of civil engineering. Available immediately. Location immaterial. D-3792.

SALES

CIVIL AND ARCHITECTURAL ENGINEER; Jun. Am. Soc. C.E.; 29; single; desires connection with sales organization; graduate licensed professional engineer and land surveyor; 8 years progressive professional experience in municipal, consulting engineering, and construction work; administration; design; drafting; supervision; inspection; surveys; sales and promotion work. Location immaterial. D-4152.

TEACHING

GRADUATE CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; age 33; C.E., M.S., D.Sc. in engineering; 10 years experience in design and erection of bridges and buildings. Also teaching experience. Well versed in statically indeterminate structures elasticity, advanced mechanics. Desires position teaching structural engineering, applied mechanics, or civil engineering subjects. Available September 1935. D-1860.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; B.S. in C.E., Armour Institute of Technology, 1932; M.S. in C.E., California Institute of Technology, 1933; 9 months experience as structural engineer. Recent graduate work in aerodynamics, theory of elasticity, geology, soil mechanics, including eight months teaching engineering drawing. Research work in sanitation and advanced theory of structures. D-4037.

RECENT BOOKS

New books of interest to Civil Engineers, donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

AERODYNAMIC THEORY, a General Review of Progress Under a Grant of the Guggenheim Fund for the Promotion of Aeronautics. Vol. III, Div. F-I. By W. F. Durand. Berlin, Julius Springer, 1935. 354 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 20 rm.

The third volume of the valuable survey of aerodynamic theory sponsored by the Guggenheim Fund, and planned to provide the student and designer with the background theory which is required. In this volume the theory of single burbling is treated by Professors C. Witoszyński and M. J. Thompson; the mechanics of viscous fluids, by Prof. L. Prandtl; the mechanics of compressible fluids, by Prof. G. I. Taylor and Mr. J. W. Maccoll; and experimental methods with wind tunnels by Messrs. A. Toussaint and E. Jacobs.

BUILDING LINES AND RESERVATIONS FOR FUTURE STREETS, THEIR ESTABLISHMENT AND PROTECTION. By R. V. Black. Cambridge, Harvard University Press, 1935. 243 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, $3.50.

Public control of private development and private building operations with a view to avoiding prohibitive cost of damages when new or widened streets are needed is discussed in the light of American experience. After a review and analysis of the existing enabling legislation, the local procedure and experience of 90 municipalities are described. Significant court decisions are given and analyzed, the economic aspects are considered, and general conclusions are drawn. There is a good bibliography and a useful selection of excerpts from model legislative forms.

CONTRACTS IN ENGINEERING, the Interpretation and Writing of Engineering-Commercial Agreements. By J. I. Tucker. 3 ed. New York and London, McGraw-Hill Book Co., 1935. 341 pp., tables, 10 × 6 in., cloth, $4.

The principles of law common to all branches of legal procedure are presented and their applications in engineering and business affairs are discussed, especially in relation to contracts. In the present edition, the chapter on writing engineering contracts has been revised, and a chapter added on evidence.

ELEMENTS OF STRENGTH OF MATERIALS. By S. Timoshenko and G. H. MacCullough. New York, D. Van Nostrand Co., 1935. 350 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.25.

This is an abridgment of Timoshenko's *Strength of Materials*, designed primarily as a textbook for undergraduate courses in engineering schools. While the principal features of the larger work are retained, the material has been rearranged and, to some extent, rewritten to conform to American methods and preferences. Numerous problems are included.

MODERN SURVEYING FOR CIVIL ENGINEERS. By H. P. Birchal. London, Chapman & Hall, 1935. 524 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 25 s.

This attractive treatise is intended to provide a convenient manual of modern methods, restricted to those branches of surveying that the civil engineer is likely to use. The surveying, estimating, and setting out of irrigation works, canals, railroads, pipe lines, dams, tunnels, bridges, piers, and other works are discussed. Chapters on photographic and aerial surveying are included, and considerable attention is given to modern instruments.

SEDGWICK'S PRINCIPLES OF SANITARY SCIENCE AND PUBLIC HEALTH. Rewritten and enlarged by S. C. Prescott and M. P. Horwood. New York, Macmillan Co., 1935. 654 pp., diagrs., tables, 9 × 6 in., cloth, $4.25.

For a generation, Professor Sedgwick's classic account of the scientific principles on which the practical arts of sanitation rest was a popular authority. The authors of the present book have undertaken to rewrite and enlarge his work in the light of recent advances, so that it may present the modern concepts of sanitary science to students of engineering, public health officials, and laymen. While as much of the original as possible has been retained, the work has been thoroughly modernized and greatly expanded, fourteen new chapters having been added to cover subjects not in the original.

THIS MODERN WORLD AND THE ENGINEER. Edinburgh, Royal Scottish Society of Arts, 1934. 140 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 5 s.

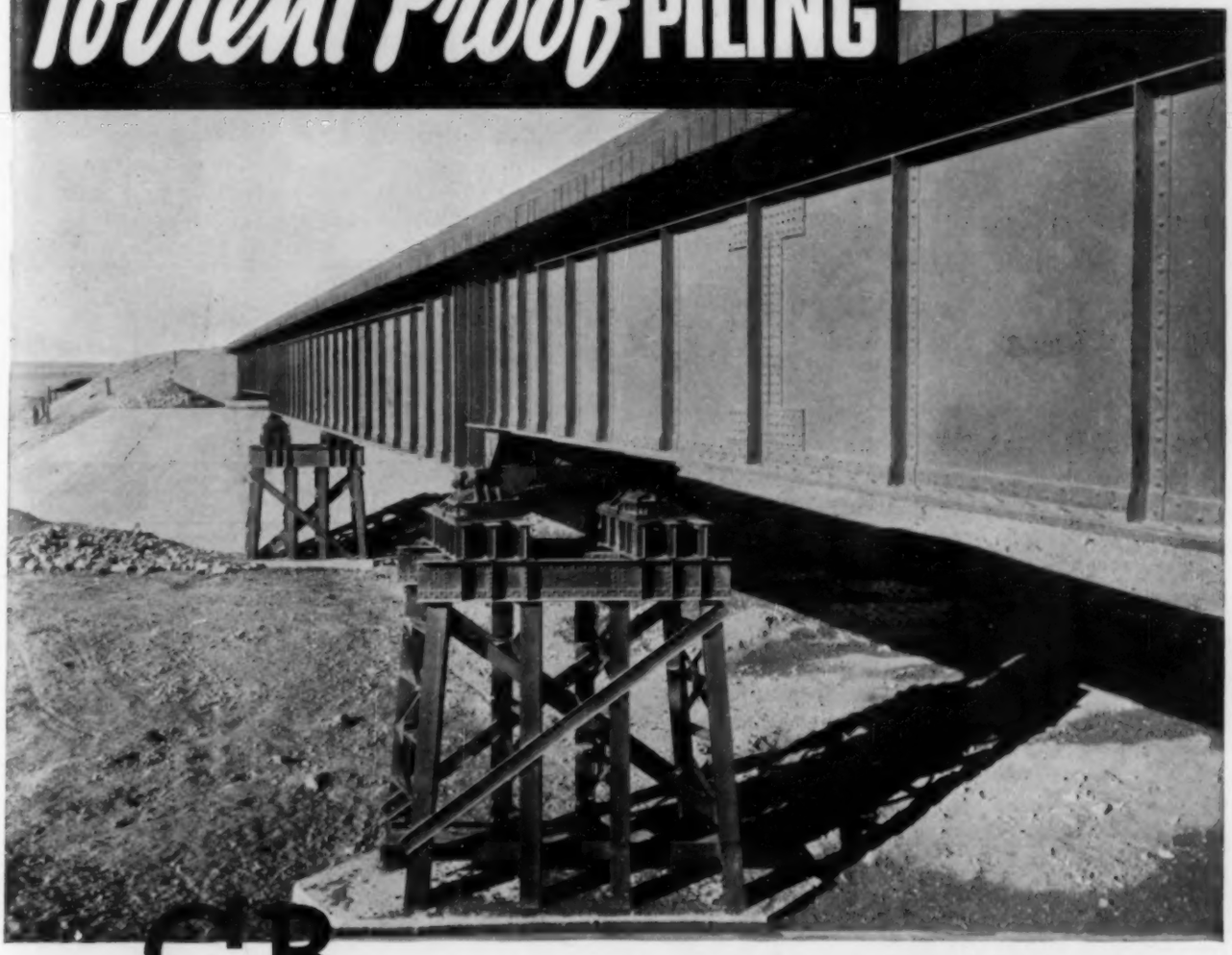
In 1933 the Keith Lectures before the Royal Scottish Society of Arts took the shape of a symposium on the "trend of modern engineering," to which six eminent engineers, chiefly from the Edinburgh School of Engineering, contributed. Their lectures discuss the achievements and problems of modern engineering in the fields of physics, civil, mechanical, electrical, and chemical engineering, and mining. A final contribution, by Prof. Henry Briggs, discusses some of the economic and social problems of engineering in general.

DIE VANADINSTAEHLE, Aufbau, Eigenschaften und Verwendung von Vanadin-legierten Stählen. By H. Hougardy. Berlin, P. u. G. Gärtner, 1934. 224 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, 8 rm.

This monograph affords a concise review of the existing information on vanadium steels. The properties and the metallurgy of vanadium, the structure and properties of its alloys with iron and carbon, and its practical use in the steel industry are presented in full. A bibliography is included.

Torrent Proof PILING

Piers constructed of steel bearing piles . . . CB SECTIONS . . . under a new bridge of the Missouri Pacific Railroad Company near Selkirk, Kansas.



CB SECTIONS

Here's a typical instance of the multiple advantages of steel bearing piles

❶ High load bearing capacity was needed. The piers shown carry a 100-foot girder span and two 70-foot girder spans.

❷ Hard driving conditions existed. Yet no difficulties were encountered in driving the steel piles through clean water-bearing sand and gravel alternating with layers of hard clay.

❸ During certain months this normally dry creek bed carries raging torrents. Dependable protection for from 15 to 20 feet against scour was needed . . . and was provided by the steel piles. Concrete protection was provided at and immediately below the stream bed to provide additional stiffness.

Steel bearing piles are rapidly gaining recognition among bridge engineers for their economy and applicability to a wide range of conditions. Additional information supplied upon request.

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BRIDGES

CONCRETE ARCH, AUSTRIA. Die neue Murbruecke in Judenburg, J. Krebitz. *Beton u Eisen*, vol. 33, nos. 21 and 22, Nov. 5, 1934, pp. 325–333, and Nov. 20, pp. 341–343. Design and construction of 3-span, concrete-arch highway bridge over the Mur River at Judenburg, Austria, having total length, including approaches, of 196 m; max. span, 50.2 m; total width, 9½ m.

CONCRETE ARCH, FRANCE. Inclined Hangers Impart Slenderness to Ribs of 470-Ft Concrete Arch, A. E. Bretting. *Eng. News Rec.*, vol. 114, no. 17, Apr. 25, 1935, pp. 577–580. Design and construction of concrete-arch, through highway bridge, 470 ft in span, over the Lot River, at Castelmoron in southern France; inclined hangers eliminate bending stresses in arch ribs; precast rib cores and bracing with crown jacks permit centering for only one-half dead load; three hinges are placed at intersections of deck with ribs and at one abutment.

FLOORS, NEW JERSEY. Designing Composite Steel and Concrete Bridge Slabs, S. Hardesty. *Eng. News Rec.*, vol. 114, no. 14, Apr. 4, 1935, pp. 484–486. Analysis of test data for lightweight slabs of concrete-filled, steel-grid type used on two recent bascule spans in New Jersey; rational design procedure; working stresses.

FLOORS, SAN FRANCISCO. Double-Deck Paving on East Approach of San Francisco–Oakland Bay Bridge. *Western Construction News*, vol. 10, no. 5, May 1935, pp. 117–120. Construction of so-called gravelite bridge pavement, using lightweight aggregate made of clay and shale, resulting in saving of 33,000,000 lb of dead weight and difficult formwork; placing slab concrete; curing; form stripping; expansion joints.

LIFT, NETHERLANDS. Lift Bridge Over Oude Meuse near Barendrecht, G. Rochat. *Brown Boveri Rev.*, vol. 22, no. 4, Apr. 1935, pp. 87–91. Sectional drawings and principal dimensions of bridge of 68.65-m span; lift 40.335 m; weight 514 kg ton; hoisting speed with main drive 0.705 m per sec; output of main hoisting motor 150 kw; description of electric equipment; principal wiring diagrams.

LIFT, NEWARK, N.J. Three-Track Vertical-Lift Bridge Has Unusual Features. *Ry. Age*, vol. 98, no. 14, Apr. 6, 1935, pp. 525–528 and 541. Structure built in connection with improvements of Pennsylvania Railroad passenger station in Newark, N.J., consists of two tower spans, each 65 ft long, and lift span, 230 ft long; vertical travel of lift span is 111 ft; bridge rests on four concrete masonry piers.

PLATE GIRDER, GREAT BRITAIN. Craigavon Bridge, Londonderry, Northern Ireland. *Engineer*, vol. 159, nos. 4137 and 4138, Apr. 26, 1935, pp. 438–439, and May 3, pp. 454–456, and 464. Old wrought-iron, 11-span girder bridge, with total length of 1,180 ft, replaced by new bridge, generally similar to old structure; new bridge is of steel and has 5 main river spans, 7 river-approach spans, and 10 land-approach spans; construction details.

PLATE GIRDER, TESTING. Die Dreirosenbruecke in Basel, L. Karner. *Schweizerische Bauzeitung*, vol. 104, no. 9, Sept. 1, 1934, pp. 93–96. Results of static and dynamic tests of steel superstructure of Dreirosen highway bridge in Basel, Switzerland, consisting of three plate girders with spans of from 75 to 105 m, built principally of special, high-grade steel.

STEEL TRUSS, CONSTRUCTION. Vorbericht ueber den bau der Strassenbruecke ueber den Rhein zwischen Neuwied und Weissenthurm, Tils. *Bauingenieur*, vol. 15, nos. 43/44, Oct. 26, 1934, pp. 439–442. Design and construction of steel-truss highway bridge over the Rhine River between Neuwied and Weissenthurn; about 685 m in total length; maximum span of 212.16 m.

STEEL TRUSS, RUPERT, PA. Reading Bridge Has Unusual Floor Construction. *Ry. Age*, vol. 98, no. 16, Apr. 20, 1935, pp. 605–606. Features of 9-span, single-track, through-truss structure with total length of 1,418 ft 9 in., near Rupert, Pa.; first railroad bridge to employ interlocked structural-steel channels in its deck construction; deck is assembly of rolled channels laid at right angles to center line of structure, with flanges alternately up and down, and with adjacent flanges interlocked and securely welded together.

SUSPENSION. Deflection Theory for Continuous Suspension Bridges, D. B. Steinman. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 400–451. Extension of deflection theory to cover suspension bridges with continuous stiffening trusses; simplified approximate formulas; numerical example of application of formulas to analysis of stresses and deflections in continuous suspension bridge of 800-ft main span. (Brief abstracts in French and German.)

VIADUCTS, CONCRETE. Modern Road Bridge Outlet for Norfolk, Va., R. P. Ellison. *Eng. News-Rec.*, vol. 114, no. 19, May 9, 1935, pp. 679–681. Features of 1,521-ft concrete viaduct with 2-leaf bascule, 237 ft in span, carrying 40-ft roadway and two 6½-ft sidewalks, located at Norfolk, Va., across eastern branch of the Elizabeth River; bascule construction; foundation and deck details.

BUILDINGS

CONSTRUCTION MATERIALS. Die Konkurrenzbaustoffe des Stahles auf dem Gebiete des Hoch- und Brueckenbaues. *Montanistische Rundschau*, vol. 26, no. 22, Nov. 16, 1934 (supp.), pp. 1–7. Materials competing with steel in field of building and bridge construction, with particular reference to reinforced concrete and, to much lesser degree, to wood.

PLASTER, COLD WEATHER CONSTRUCTION. Neue Instruktionen fuer die Ausfuehrung von Zement-Putzarbeiten bei Frost in der Sowjet-Union, W. Wichmann. *Zement*, vol. 24, no. 5, Jan. 31, 1935, pp. 69–72. New regulations for carrying out cement plastering at freezing temperatures in the Soviet Union.

CONCRETE

ADMIXTURES. Étude sur l'influence des mélanges de matiéres, pulvérulentes et ciment dans la résistance des mortiers et bétons, J. Cartiaux. *Revue des Materiaux de Construction et de Travaux Publics*, no. 302, Nov. 1934, pp. 309–311. Influence of mixtures of powdered materials and cement on strength of mortars and concrete; effects on strength of varying proportion of cement, lime, sand, slag, and stone were observed.

MIXING. Kornzusammensetzung von Betonzuschlaegen zur Erzielung groesster Dichte, G. Rothfuchs. *Zement*, vol. 24, no. 1, Jan. 3, 1935, pp. 8–12. Gradation of concrete aggregates for maximum density; experiments show that when amount of material retained on each sieve size is plotted against square root of opening of sieve, straight line results for most dense mixture; formula given for this mixture; straight-line relationship provides simple method of combining different aggregate sizes in such manner that they give maximum density.

TESTING. Analysis of Concrete. *Cement & Cement Manufacture*, vol. 8, no. 4, Apr. 1935, pp. 108–113. Outline of practice of two British firms of cement and concrete testers, R. H. Harry Stanger and Woodcock and Mellersh; preparation of sample; analysis of fine stuff; treatment of precipitates; determination of iron, sulfuric anhydride, and carbonic anhydride; interpretation of results; analysis of "fine stuff."

CONSTRUCTION INDUSTRY

COSTS. Unit Bid Summary. *Western Construction News*, vol. 10, no. 5, May 1935 (adv. sec.), pp. 50, 52, 54, 56, and 58. Unit costs bid for construction of water works, tunnels, dams, etc., in California, Utah, Arizona, and Montana.

DAMS

CONCRETE, AUSTRALIA. Hume Dam on Murray River. *Engineer*, vol. 159, no. 4139, May 10, 1935, pp. 480–482. Dam being built for capacity of 1,250,000 acre-ft; consists of central section, built of concrete 1,042 ft 6 in. in length, with embankments on either side, 430 ft 6 in. and 3,913 ft in length, respectively.

CONCRETE GRAVITY, CONSTRUCTION. Progressive Cofferdamming for Long Low Dam. *Eng. News-Rec.*, vol. 114, no. 14, Apr. 4, 1935, pp. 473–477. Construction of dam no. 3 of the Allegheny River navigation works, 1,358 ft long, about 28.5 ft high; this navigation dam, which is of concrete-gravity section carried on piles, has been constructed by advancing cofferdam in five steps and tearing down behind as concreting of each dam section was completed; bulkhead construction; piledriving; concreting forms and equipment; concrete vibration.

HYDRAULIC FILL, MONTANA. Year's Progress at Fort Peck Constructing Servicing Adjuncts. *Eng. News-Rec.*, vol. 114, no. 19, May 9, 1935, pp. 659–664. One year's construction progress on world's largest earth dam, which is to cost $86,000,000; building railways, roads, power lines, city for 8,000 people, four hydraulic dredges, and hundreds of boats, barges, and pontoons; electric-power services; construction of shipyard in northern Montana.

RESERVOIRS, FLOOD RETARDING. Slide Rule for Routing Floods Through Storage Reservoirs on Lakes, C. J. Posey. *Eng. News-Rec.*, vol. 114, no. 17, Apr. 25, 1935, pp. 580–581. Construction of slide rule for routing floods through reservoirs, giving final stage and final outflow from setting involving known values of total inflow and initial outflow; nomogram which may be used in place of slide rule in cases where routing computations are not extensive.

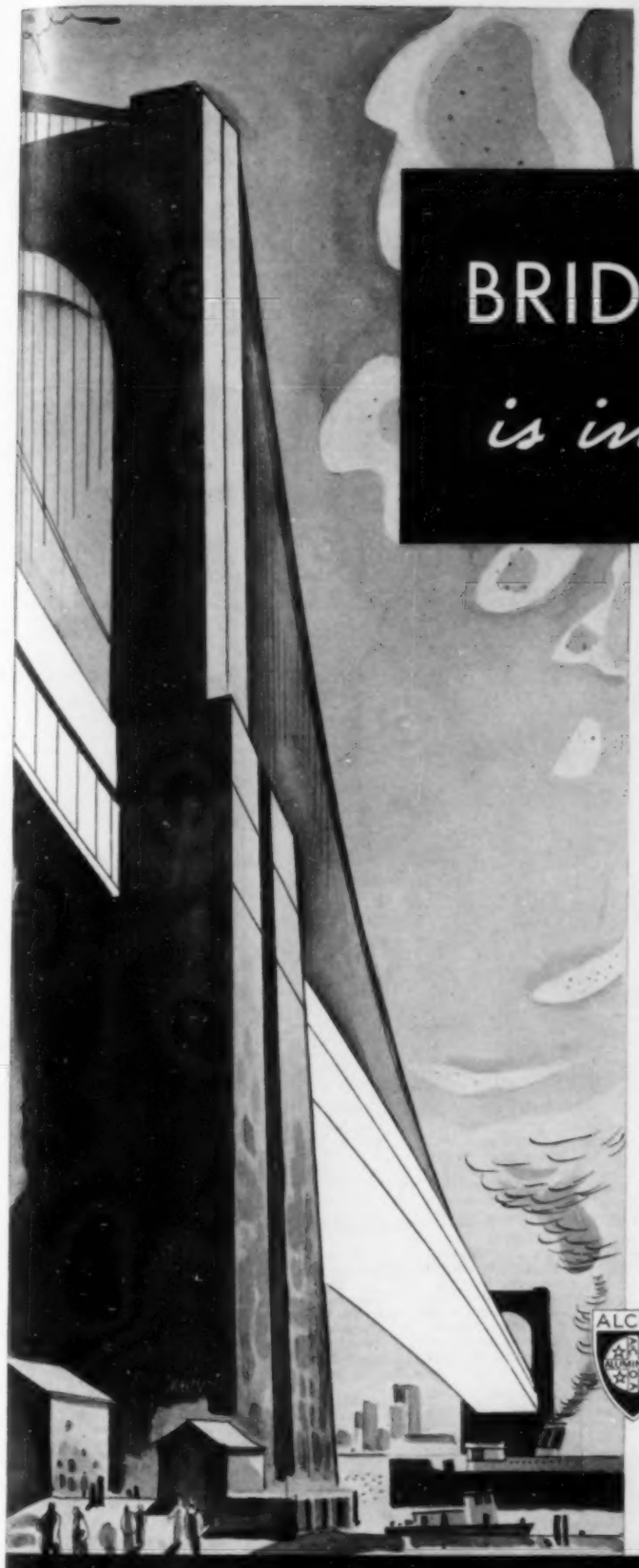
FLOOD CONTROL

ARTIFICIAL. Une crue artificielle sur l'Aar, B. Lacaze. *Revue Industrielle*, vol. 65, no. 2309, Apr. 1935, pp. 161–171. Report on artificial flood wave produced on Aar River, Switzerland, on Feb. 6, 1920, based on report by K. Kobelt published by Service Fédéral des Eaux, Switzerland; observations on progress of wave; bearing of observations on effect of pumped storage released into river.

MISSISSIPPI RIVER. Revised Plan of Flood Control for Mississippi River. *Eng. News-Rec.*, vol. 114, no. 14, Apr. 4, 1935, pp. 492–494. Discussion of main revision providing for payment for land rights for floodways, substitution for Boeuf floodway of controlled floodway in Tensas Valley, in Atchafalaya Basin, and flood control of St. Francis and Yazoo rivers; summary of costs.

HYDRAULIC ENGINEERING

IRRIGATION CANALS, DROPS. Irrigation Canal Falls. *India, Central Board of Irrigation—Pub. 1*, No. 10, Feb. 15, 1935, 62 pp., 9 supp. sheets. Theory of drops on irrigation canals; classification of falls; filling-basin element; filling basins for impact by "vertical" stream and horizontal stream; filling basins for impact by stream flowing down inclined glacis; filling basins in which there is no impact; deflector; formulas for depth of filling basins; design of flumed falls with glacis, baffles, and deflectors. Bibliography.



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MATERIALS TESTING

RIVETED JOINTS, FATIGUE. Die Dauerfestigkeit von Niet- und Schweissverbindungen, K. Schaechterle. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 312–379. Fatigue strength of riveted and welded joints and design of dynamically stressed structural members based on conclusions drawn from fatigue tests; historical review of test results. (Brief abstracts in French and English.)

ROAD MATERIALS. Materials Argentinos Para Macadam. J. Allende Posse. *Caminos*, vol. 1, no. 7, Mar. 1935, pp. 176–183. Argentine materials for macadam; analysis of mechanical function that aggregate should fulfill to offer compact and solid structure; essential chemical and mechanical properties of rocks; graphic test data on Argentine rocks; criteria that should guide road designer in selection of rock for each case; precautions to be observed in constructing this type of pavement.

WELDS, FATIGUE. Ueber die Dauerfestigkeit von genieteten und geschweissten Vervindungen aus Baustahl St. 52, E. H. Schulz and H. Buchholtz. *Assn. Int. des Ponts et Charpentes—Mémoires*, vol. 2, 1933–1934, pp. 380–399. Tests of fatigue strength of riveted and welded joints made of steel St. 52; tests justify adoption of welded joints where vibrating stresses are to be resisted. (Brief abstracts in French and English.)

PORTS AND MARITIME STRUCTURES

ANTWERP. Port of Antwerp Attaining Record Trade Pace. *Nawt. Gaz.*, vol. 125, no. 6, Mar. 16, 1935, pp. 5–8. Port features, characteristics, and developments; tables giving inward tonnage, and sea-borne goods traffic, covering period from 1929 to 1934.

BREAKWATERS, CALIFORNIA. New Type Breakwater Lowers Construction Costs, J. R. Marcy. *Excavating Engr.*, vol. 29, no. 3, Mar. 1935, pp. 122–126 and 154. Features of new breakwater for San Pedro port of Los Angeles, 12,500 ft long, about 60 ft high; incorporation of sand and clay core effects 50 per cent saving.

PACIFIC COAST. Practicable Port Development, A. H. Abel. *Pac. Mar. Rev.*, vol. 32, no. 3, Mar. 1935, pp. 83–85. Some of the problems surrounding new port projects and their economic practicability on Pacific Coast.

PIERS, FIRE PREVENTION. Report of Committee on Piers and Wharves. *Nat. Fire Protection Assn.—Advance Paper*, mtg., May 13 to 16, 1935, 21 pp. Recommended good practice for construction and protection of piers and wharves.

SAVANNAH, GA. Savannah—Georgia's Port, J. H. Winkers. *Naut. Gaz.*, vol. 125, no. 7, Mar. 30, 1935, pp. 5–7 and 9–10. Impartial statistical analysis; brief historical review; progress made; services and facilities offered by port; characteristics.

SHORE PROTECTION. Permeable Groins of Concrete Check Beach Erosion, E. A. Howard. *Eng. News-Rec.*, vol. 114, no. 17, Apr. 25, 1935, pp. 594–596. Beach and bluff at Cudahy, Wis., on Lake Michigan, protected by drain back of crest to intercept surface water, drains tapping face of bluff for underground water and permeable outshore groins to build up beach; theory of progressive permeability in construction of groin; permeability of groin to flow of water through structure increasing with distance out from shore; groins were built of pre-cast concrete elements.

ROADS AND STREETS

BITUMINOUS. Needed Research on Flexible-Type Bituminous Roads, E. F. Keiley. *Pub. Roads*, vol. 16, no. 2, Apr. 1935, pp. 32–33. Chief of Division of Tests of U. S. Bureau of Public Roads emphasizes necessity of more satisfactory tests for identification of bituminous materials; only fragmentary information available on load distribution.

BRICK, ILLINOIS. Resurfacing City Pavement with Brick. M. P. O'Brien. *Am. City*, vol. 50, no. 4, Apr. 1935, pp. 52–54. Experience of Springfield, Ill.; correcting grade; special templates; setting brick. Before Nat. Paving Brick Assn.

BRICK, IOWA. Study of Lives of Brick-on-Concrete Pavements, A. Marston. *Pub. Roads*, vol. 16, no. 1, Mar. 1935, pp. 3–6 and 14. Results of "mortality-curve" study of actual service lives of brick-on-concrete pavements in Des Moines, Iowa, 1909–1928, inclusive; estimating probable lives of similar pavements still in service. Before Highway Research Board at Washington, D.C.

CONSTRUCTION. Compacting Highway Fills in California. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, pp. 565–566. Description of combined laboratory and field methods; tests used in compacting highway embankments in California.

DESIGN. Highway Through City Relocated in New 200-Ft Right-of-Way. *Eng. News-Rec.*, vol. 114, no. 13, Mar. 28, 1935, pp. 439–444. Road through Newburyport, Mass., placed in blocks formerly occupied by old buildings; divided roadways, rigid-frame and continuous-girder bridges, and cut, fill, and retaining-wall work included in $1,000,000 job.

DETROIT. Bridge and Paving Work in Detroit Street Widening. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, pp. 559–563. Construction of two-thirds of a mile of 90-ft pavement on Woodward Ave., Detroit, Mich., illustrating latest practice trends in constructing sheet asphalt on concrete base.

EXPANSION JOINTS. Transverse Contraction and Expansion Joint Design, R. E. Toms. *Am. Highways*, vol. 14, no. 2, Apr. 1935, pp. 9 and 12–15. Principles of design and results of experience in United States; effect of dowel spacing on reduction of edge stress computed by Westergaard's exact method.

FROST DAMAGE. Sand Cushions as Protection Against Frost Heaving. *Roads & Streets*, vol. 77, no. 11, Nov. 1934, pp. 405–406. Report on experiments to determine efficiency of sand cushion to eliminate action of frost in ground made by Provincial Department of Roads of Quebec; placing sand cushion.

HIGHWAY SYSTEMS, UNITED STATES. Broadening Highway Program, T. H. Macdonald. *Pub. Roads*, vol. 16, no. 1, Mar. 1935, pp. 1–2 and 11. Review of highway program in United States by chief of Bureau of Public Roads; termination of pioneer phase brings new problems in road building; balanced program must be formulated.

LANDSLIDES. Skilful Work of Engineers Saved Highway in 200,000-Cu Yd Slide, J. H. Skeggs. *Calif. Highways and Pub. Works*, Apr. 1935, pp. 22–23. Utilizing material of huge landslide on new state highway between Sausalito and San Rafael, near San Francisco, for widening roadbed on each side of slide; 200,000 cu yd of material moved and traffic maintained at all times.

LOW COST. Semi-Flexible Road Surfaces as Dynamically Rigid Slabs, H. G. Nevitt. *Eng. News-Rec.*, vol. 114, no. 15, Apr. 11, 1935, pp. 517–520. Design and construction of new type of road surface, combining advantages of both rigid slab and flexible surface; semi-flexible design utilizes both beam-stress distributing action of former and subgrade support of latter.

MOTOR TRANSPORTATION, COSTS. Motor Vehicle Operating Cost as Affected by Road Surfaces, R. Winfrey. *Am. Highways*, vol. 14, no. 2, Apr. 1935, pp. 4–8. Discussion of cost factors and literature; fuel consumption and power requirements; oil consumption; tire and tube costs; maintenance; depreciation; accident insurance costs; calculation of costs for vehicles operating on different road surfaces; summary and recommendations for future work.

RAILROAD CROSSINGS, ELIMINATION. SEATTLE. Grade Separation Commission. Report on Separation of Grades in South End Industrial District, May 1930, 107 pp., diagrs., charts, maps, tables. Commission appointed to study permanent separation of street and railway grades in industrial and railway district of Seattle, and prepare advisory plans for its accomplishment; three schemes considered and cost estimates prepared are presented in detail; drawings of proposed viaducts, retaining walls, etc., included in report. Eng. Soc. Lib., N.Y.

ROADSIDE IMPROVEMENT. Roadside Planting Survives Drought, J. M. Hall. *Pub. Roads*, vol. 16, no. 2, Apr. 1935, p. 34. Result of survey made on Iowa project on primary road No. 15, extending north from Ames 32 miles to junction with U. S. route No. 20 at Blairsburg; percentage of survival of plants at end of first growing season.

SIGNALS AND SIGNALING. Selective Speed Control for Crossing Signals. *Ry. Signaling*, vol. 28, no. 2, Feb. 1935, pp. 67–69. Notes on flashing-light signals equipped with rotating disk stop signs as well as "two-train" indicators, installed at Bayswater Avenue, and at Peninsular Avenue, in Burlingame; control of entire crossing signal equipment centers in normally energized stick relay for each track; track plan showing location of special controls.

SOILS, CONSOLIDATION. Stabilization of Soils by Use of Bitumen Emulsion, C. H. Haswell. India, Simla, Central Board of Irrigation. *Publication No. 9*, Feb. 1, 1935, 13 pp., figs., diagrs., charts, tables. Results of original experiments in Karachi, India; critical review of Hogentogler's theory on liquid limit of soils; application of experimental results to construction of road surfaces, irrigation canal linings, etc.; effect of snow and frost; precautions against frost; result of tests on Hab River road.

UNITED STATES. Current Status of United States Public Works Road Construction. *Pub. Roads*, vol. 16, no. 3, May 1935, pp. 53–55. Tabulated data on projects on federal-aid highway system outside of municipalities, as of April 30, 1935; projects on extensions of federal-aid highway system into and through municipalities, as of April 30, 1935; projects on secondary or feeder roads, as of same date.

SEWERAGE AND SEWAGE DISPOSAL

CHEMICAL PROCESS. Evaluation of Chemical and Other Methods of Sewage Treatment, A. Potter and E. T. Killam. *Water Works and Sewerage*, vol. 82, no. 4, Apr. 1935, pp. 129–132. Reconciliation between unfavorable history and recent creditable performance; objectionable nature and difficulty of handling chemical sludge; impossibility of obtaining nonputrescible effluent; complications in selection of sewage treatment method; preliminary comparison of alternate methods; essential elements of simple chemical-type plant.

CHLORINATION. Effect of Chlorination on Activated Sludge. I—Effect of Complete Chlorination, W. Rudolfs and N. S. Chamberlin. *Water Works and Sewerage*, vol. 82, no. 4, Apr. 1935, pp. 109–111. Report on experimental studies made at New Jersey Agricultural Experiment Station; bio-chemical oxygen demand of activated sludge and of mixed liquor; turbidity of supernatant and sludge volume of mixed activated sludge; bio-chemical demand of supernatant of mixed activated sludge.

INDUSTRIAL WASTES. Treatment of "Beer Slop" and Similar Wastes, A. M. Buswell. *Water Works and Sewerage*, vol. 82, no. 4, Apr. 1935, pp. 135–138. Correcting interferences with anaerobic treatment; feeding and gas production rates obtained during thermophilic digestion of various industrial wastes; analysis of citrus pulp; effluent quality; comparison of costs; recovery of stock food. Bibliography.

PLANTS, NEW YORK. Proposed Coney Island Sewage Treatment Works of New York City, R. H. Gould. *Water Works and Sewerage*, vol. 82, no. 2, Feb. 1935, pp. 53–57. Description of 35-mgd plant proposed for immediate construction, which is to treat domestic sewage containing unusually high amounts of sulfates and chlorides; sludge disposal; extension of works; cost estimated at $1,823,000.

PLANTS, ST. ALBANS, VT. Sewage-Treatment Processes Aided by Long Outfall, H. W. Taylor. *Eng. News-Rec.*, vol. 114, no. 21, May 23, 1935, pp. 739–741. Description of new sewage-disposal plant of St. Albans, Vt., having population of 9,000; agitation and aeration in 3½-mile outfall line to supplement purification provided by aeration and sedimentation in plant; storm-water overflow is retained in lagoon until flow in sewer subsides and is then passed through treatment plant; total construction cost will be about $92,000.

PLANTS, WASTE UTILIZATION. Staedtereinigung und heimische Rohstoffversorgung, A. Heilmann. *Gesundheits-Ingenieur*, vol. 57, no. 47, Nov. 24, 1934, pp. 634–638. Further suggestions on utilization of refuse for recovery of raw materials; use of methane gas recovered from sewage disposal plants; gasification of wood; lignite and anthracite coke; utilization of oil waste.

REFUSE DISPOSAL, GRINDING. Grinding of Garbage for Disposal in Sewers, F. J. McDevitt. *Am. City*, vol. 50, no. 3, Mar. 1935, p. 58. Operating results of experimental plant with capacity of 100 tons per day tried out in St. Louis, Mo.; raw garbage ground up into pieces to pass ¼-in. mesh; danger of river pollution.

SEWERS, CONSTRUCTION. Sewer Reconstruction Problems in Subway Building, S. D. Bleich and A. Brahdy. *Eng. News-Rec.*, vol. 114, no. 16, Apr. 18, 1935, pp. 552–556. Solution of general and special problems involved in rebuilding 60 miles of sewer in recent rapid-transit subway construction in New York City; inverted siphons; track drains and underground streams; provision for future work.

SLUDGE. Drying Sewage Sludge on Vacuum Filters, F. W. Jones. *Am. City*, vol. 50, no. 1, Jan. 1935, pp. 43–45. Review of experience with dewatering of sewage sludge in several American cities with special reference to work done in Cleveland, Ohio; area required; cost of sludge dewatering by sand filters; sludge dewatering costs by vacuum filtration. Before Pa. Sewage Works Assn.

SLUDGE, FERTILIZER. Sewage Sludge, Its Preparation and Sale, M. W. Tatlock. *Water Works and Sewerage*, vol. 82, no. 3, Mar. 1935, pp. 85–88. Experience of sewage treatment works of Dayton, Ohio, in preparing and marketing sewage sludge fertilizer; economies in plant operation; operation of sludge disintegrator; expenditures and operating costs; production and sales.

SLUDGE TESTS. Sewage-Sludge Fuel Value Related to Volatile Matter, G. M. Fair and E. W. Moore. *Eng. News-Rec.*, vol. 114, no. 19, May 9, 1935, pp. 681–683. Analysis of existing data to determine relationship between heat value and volatile matter content; equations for determination of heat value in connection with disposal of sludge by incineration; fuel value of plain-sedimentation sludge and of activated sludge as disclosed by tests. Bibliography.

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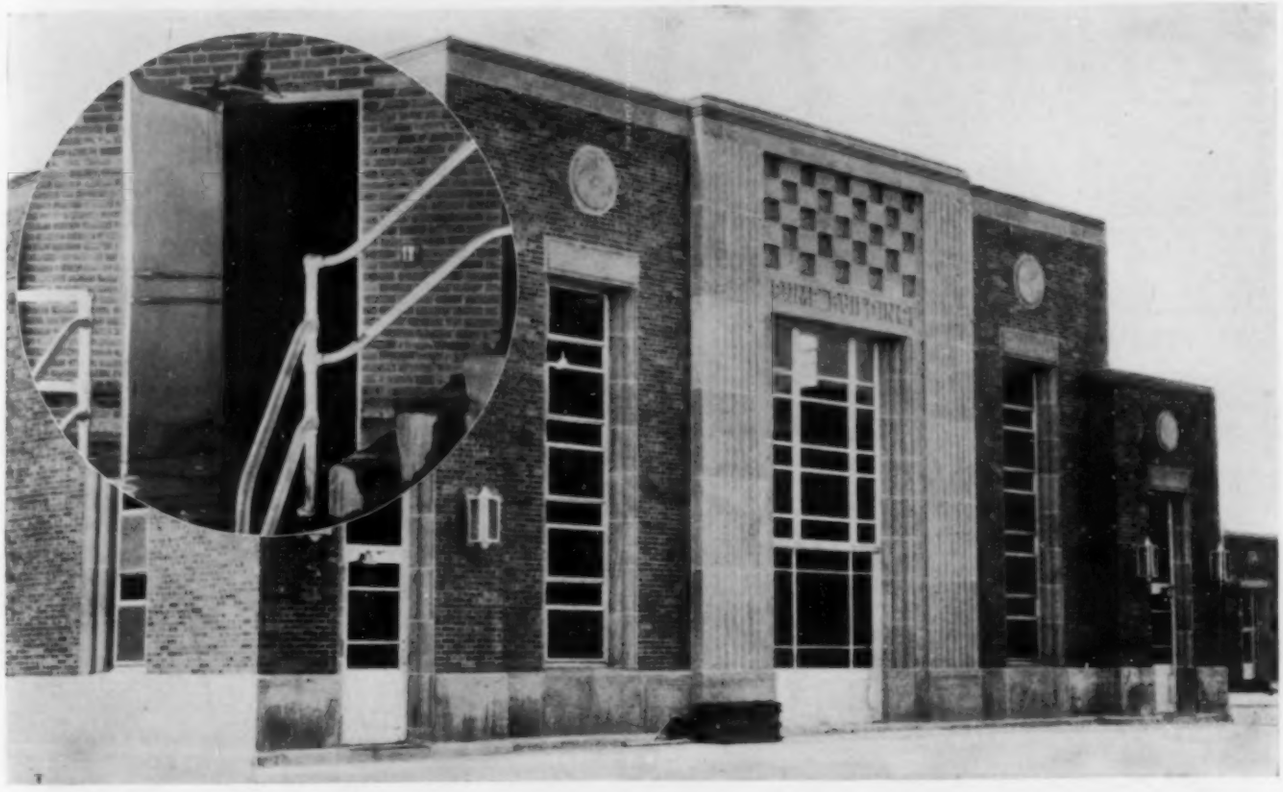

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BRIDGES

CONCRETE ARCH, ONTARIO. Concrete Bowstring Arch Bridge Across Grand River at Bridgeport, Ontario, D. J. Emrey. *Eng. J.*, vol. 18, no. 6, June 1935, pp. 300–304. Five-span reinforced-concrete bridge totaling 457 ft in length; net reinforced concrete bridge totaling 457 ft in length; net width 26 ft; data on construction quantities and man days of labor.

CONCRETE, CONSTRUCTION. Practical Application of Vibration, C. M. Hathaway. *Am. Concrete Inst.—J.*, vol. 6, no. 4, Mar.-Apr., 1935, pp. 420–423. Review of satisfactory practice of Illinois State Highway Department in construction of concrete bridges.

CONCRETE, RICHMOND, VA. Richmond Completes Interesting Program of Bridge Construction. *Eng. News-Rec.*, vol. 114, no. 23, June 6, 1935, pp. 808–812. Features of three concrete-arch bridges and two rigid-frame concrete viaducts built mostly by relief labor in and around Richmond, Va.; bridge arches are up to 190 ft in span; plywood was used extensively as form lining on all bridges.

HIGHWAY, OREGON. Self-Liquidating Plan for Oregon's Coast Highway Bridges, C. B. McCullough. *Eng. News-Rec.*, vol. 114, no, 23, June 6, 1935, pp. 814–815. Features of five highway bridges to be constructed on the coast with the aid of a PWA loan; predicted average daily volume of traffic; financial set-up.

PIERS, CONSTRUCTION. Storstroem-salmen silta, K. T. Groenroos. *Teknillinen Aikakauslehti*, no. 4, Apr. 1935, pp. 147–152. Construction of concrete bridge piers for steel arch bridge over Storstroem Sound between Falster and Seeland Island, Denmark; over 3 km long.

RAILROAD, DENMARK. Little Belt Bridge. *Ry. Gaz.*, vol. 62, no. 21, May 24, 1935, pp. 1028–1031. New high-level bridge built to avoid recurring cost of train ferry it replaces and to improve communication facilities in Denmark; illustrations.

STEEL, WELDING. Welded Steel Arch of 166-Foot Span in Czechoslovakia, F. Faltus. *Am. Welding Soc.—J.*, vol. 14, no. 5, May 1935, p. 8. Bridge designed and built by Skoda Works of Pilsen is one of largest welded bridges undertaken and is believed to be first all-welded arch; consists of two 2-hinged arch ribs spaced 20 ft 8 in. apart, having rise of 35 ft; arch ribs are built up of 9/8-in. webs, 2 ft 11 in. deep, and two flange plates, 16 1/2 in. wide; total width of structure is 29 1/2 ft; weight is 110 tons, of which 47 tons comprise weight of arch ribs.

SUSPENSION, TOWERS, DESIGN. Battery-Leg Towers for San Francisco Bay Bridge, C. H. Purcell, C. E. Andrews, and G. B. Woodruff. *Eng. News-Rec.*, vol. 114, no. 25, June 20, 1935, pp. 865–867. Design of four towers, over 400 ft high, of twin suspension spans comprising West Bay crossing of San Francisco–Oakland Bay Bridge for exceptional lateral stability with seismic stress allowance of 0.1 force of gravity; stress calculations; tower top deflections.

WOODEN, CONSTRUCTION. Preframing Proves Practical, L. G. Byrd. *Ry. Eng. & Maintenance*, vol. 31, no. 4, Apr. 1935, pp. 224–225. Method employed on the Missouri Pacific in pre-cutting and pre-boring timbers for trestle construction.

BUILDINGS

EARTHQUAKE EFFECTS. Period of Vibration as Index of Structural Integrity, J. J. Creskoff. *Engineering*, vol. 139, no. 3,622, June 14, 1935, pp. 618–620. In author's opinion method of measuring and comparing free periods of vibration of buildings, both before and after earthquakes, affords direct method of determining building damage, whether visible or not; both theory and experience indicate that the smaller the periods the larger the elastic resistance.

EARTHQUAKE RESISTANCE. Earthquake Resisting Design, C. R. Ford. *Roy. Inst. Brit. Architects—J.*, vol. 42, 3d series, no. 15, June 8, 1935, pp. 882–888. Distribution and frequency of earthquakes; factors governing damage to buildings; nature and analysis of earth movements; economics of a seismic design. Before New Zealand Inst. Architects.

STRUCTURAL STEEL, WELDING. Welded Steel Structures—Recent Developments in Europe, A. R. Moon. *Structural Engr.*, vol. 12, no. 11, Nov. 1934, pp. 464–473. Review of welding methods used on several building construction and bridge erection jobs in Italy, Belgium, Germany, etc. Before Instn. Structural Engrs.

CITY AND REGIONAL PLANNING

EFFECTS OF DEPRESSION. What Depression Has Done to Planning, C. S. Ascher. *Pub. Mgmt.*, vol. 17, no. 2, Feb. 1935. pp. 35–37. Planning was one of municipal activities to be abolished by depression in business conditions; ways in which rôle of government in economic life may force planning.

MUNICIPAL ENGINEERING, GREAT BRITAIN. Problems of Growing Suburb: Case of Heston and Isleworth, O. P. F. Hilton. *Instn. Mun. & County Engrs.—J.*, vol. 61, no. 22, Apr. 23, 1935, pp. 1179–1218, (discussion) 1218–1224. Notes on street planning, street lighting, refuse collection and disposal, sewer system, sewage disposal, river protection works, housing, parks, schools, swimming pools.

UNITED STATES. City Planners Look to Suburbs as Living Areas of Next Decade. *Eng. News-Rec.*, vol. 114, no. 24, June 13, 1935, pp. 839–840. Proceedings of joint conference of American City Planning Institute, American Civic Assn., American Society of Planning Officials, and National Conference on City Planning.

CONCRETE

BAR SPACERS. Asbestos-Cement Bar Spacers, G. P. Manning. *Concrete & Constr. Eng.*, vol. 29, no. 11, Nov. 1934, pp. 707–708. Author recommends use of asbestos-cement spacers three-eighths of an inch thick in placing reinforcement of concrete columns.

CONSTRUCTION, CEMENT-GUN. Cement-Gun Practice, B. Frisby. *Power Engr.*, vol. 30, no. 350, May 1935, pp. 184–186. Brief survey of the process and its wide application in industrial and power-plant practice.

CONSTRUCTION, COLD WEATHER. Die Fortschritte des Elektrobetons, A. Réthy. *Beton u Eisen*, vol. 33, no. 18, Sept. 20, 1934, pp. 277–282. Review of progress in practice of electric heating of concrete construction during cold weather, as developed in the Soviet Union; construction of industrial buildings in Ural Mts.; construction of Moscow subway, etc.

CONSTRUCTION, PUMP PLACING. Experience in Pumping Cement Through Pipe Line Over Mile Long. *Rock Products*, vol. 38, no. 3, Feb. 1935, pp. 48–50. Installation used at Boulder Dam in connection with making and placing concrete for dam construction; pneumatic pump unit consists of two pump tanks mounted side by side on structural support; operating cycle described; illustrated description of pneumatic cement transport lien from high-level to low-level concrete mixing plant.

CONSTRUCTION, VIBRATING. Vibration and Pervibration in Concrete Depositing, T. J. Gueritte. *Structural Engr.*, vol. 13, no. 2, Feb. 1935, pp. 92–105. Early experiments; mechanical vibration; hand ramming uncertainty avoided; pneumatic vibrators; compressed air vibrators; electric vibrators; pervibration; comparison of results. Before Instn. Structural Engrs and Société des Ingenieurs Civils de France.

CURING. Report of Investigation. Curing of Concrete Pavement Slabs, R. W. Crum. *Nat. Research Council—Highway Research Board—Proc.*, Pt. II, mtg. Dec. 7–8, 1933, 96 pp. Report of Committee on Curing of Concrete Pavement Slabs; Review of Data on Calcium Chloride Admixture Method of Curing Concrete Pavements, H. H. Miller; Review of Data on Bituminous Coatings and Relation of Temperature to Curing Methods, H. F. Gonnerman; Sodium Silicate—Review of Recent Investigations, F. V. Reagel; Use of Paper for Curing Concrete Pavements, M. Morris; Intermittent Curing of Concrete, F. C. Lang; discussions by J. S. Crandell, H. J. Gilkey, F. C. Lang, F. R. Richart, L. C. Stewart, S. B. Slack, and A. R. Evarts; Curing Concrete Pavements: Review, R. W. Crum.

PROTECTIVE COATINGS. Natronwassergias als Betonschutzmittel, C. R. Platzmann. *Tonindustrie-Ztg.*, vol. 58, no. 101, Dec. 17, 1934. pp. 1234–1235. Sodium water glass as protective agent for concrete; critical discussion of its alleged advantages as set forth by G. Balbachevsky, of Brussels.

REFRACTORY MATERIALS, CEMENT. Ueber feuerfeste Moertelmassen, A. Braniski. *Tonindustrie-Ztg.*, vol. 59, no. 11, Feb. 4, 1935, pp. 143–144. Refractory mortars; contribution to manufacture of refractory monolithic linings.

VIBRATING. Placing Concrete by Means of Vibration, A. E. Lindau. *Am. Concrete Inst.—J.*, vol. 6, no. 4, Mar.–Apr. 1935, pp. 417–419. Review of work by American Concrete Institute Committee 609 on vibration of concrete.

CONSTRUCTION INDUSTRY

COSTS. Unit Bid Summary. *Western Construction News*, vol. 10, no. 6, June 1935 (adv. sec.), pp. 44, 46, 48, and 50. Unit costs bid on dam construction, street and road work, railroad construction, bridges and culverts, water supply systems and sewer construction in Colorado, California, Oregon, Utah, and Montana.

DAMS

BOULDER DAM, PENSTOCKS. Erecting Penstock Pipe Sections at Boulder Dam, W. R. Nelson. *Western Construction News*, vol. 10, no. 6, June 1935, pp. 143–147. Description of unusual equipment and new methods developed for transporting and jointing units 30 ft in diameter; record size trailer of 200-ton capacity; unique type of cold-pinned connection used on girth joints of large sections of pipe; connections to main headers; painting and testing.

CONCRETE ARCH, MODELS. Model Tests on Concrete Arch Dams. *Engineering*, vol. 139, no. 3621, June 7, 1935, pp. 591–592. Review of second volume of *Arch Dam Investigation* issued by Engineering Foundation, New York, N.Y., covering work done in connection with small models of Stevenson Creek Test Dam and Gibson Dam, together with account of auxiliary tests of concrete specimens made in connection with experiments on these models.

CONCRETE GRAVITY. High Speed in Concreting at Norris Dam. *Eng. News-Rec.*, vol. 114, no. 20, May 16, 1935, pp. 698–701. Skillful mechanization in detail, devices, and in general plant arrangement is setting records which exceed by a third yardages estimated to be practicable; sequence of operations; form construction and handling; internal vibrators; concrete placing.

FOUNDATIONS. Cofferdam 3,000 Ft Long Built at Grand Coulee. *Western Construction News*, vol. 10, no. 6, June 1935, pp. 162–164. Method of construction of sheet-pile cofferdam of cellular type; 7,053 piles, involving more than 12,500 tons of steel and having total length of about 791,000 ft were driven in 3 months; description of gravel and concrete plants.

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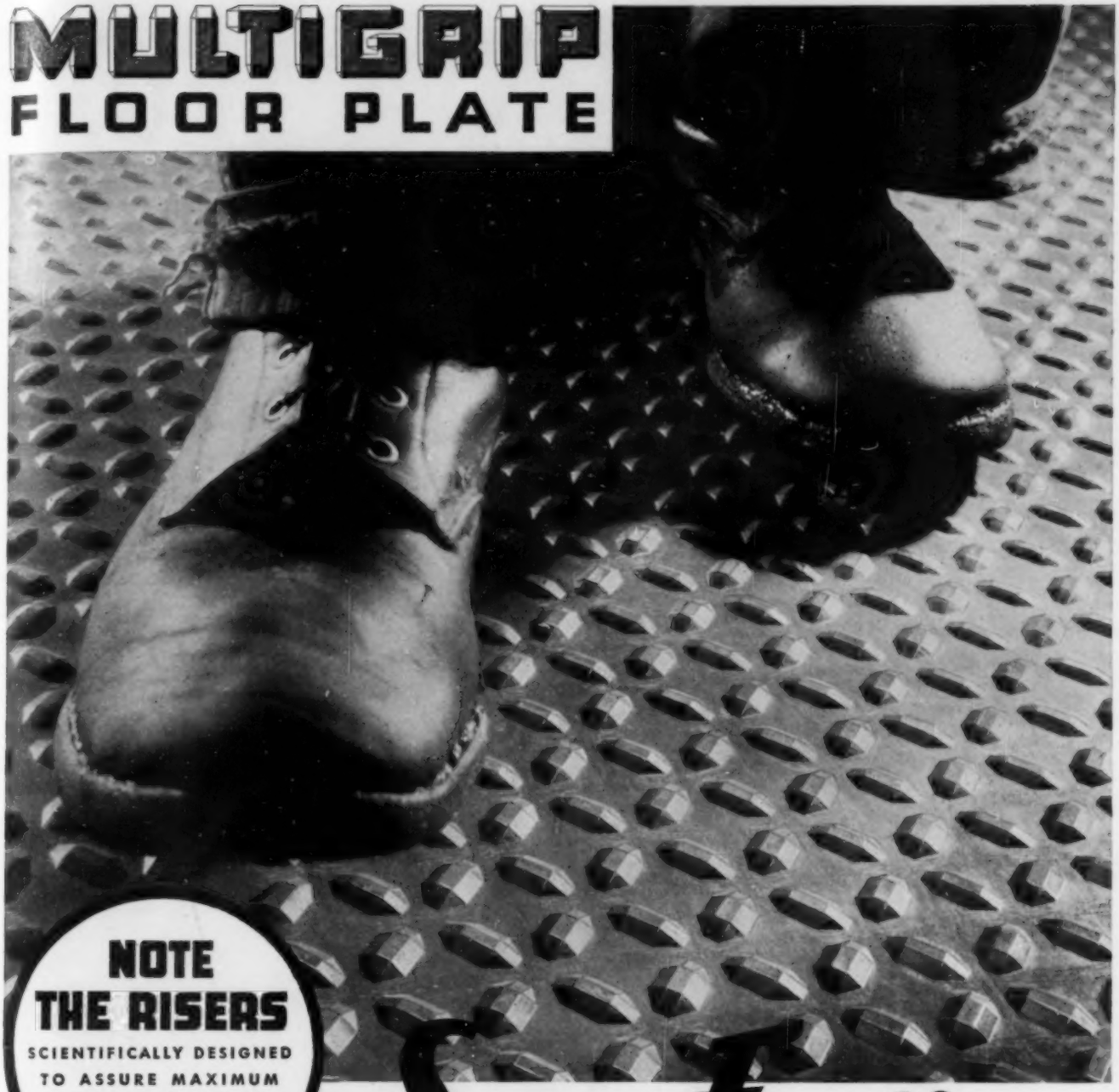

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HYDRAULIC FILL, SHRINKAGE. Shrinkage of Hydraulic Fill in Miami Conservancy Dams, C. H. Eiffert. *Eng. News-Rec.*, vol. 114, no. 14, Apr. 4, 1935, pp. 482–483. Recapitulation of shrinkage records obtained since 1921 on Huffman and Germantown flood-protection dams; shrinkage progress; earth-pressure records.

LEVEES, MATERIALS. Die Unterscheidung von Loess und Hochflutlehm, H. Quiring. *Zeit., fuer praktische Geologie*, vol. 42, no. 10, Oct. 1934, pp. 145–156. Distinction between loess and alluvial loam; discussion of properties of loess and loam and their adaptability to construction of dikes and levees. Bibliography

ROCK-FILL REPAIR. Flexible Timber Facing Applied to San Gabriel Dam No. 2, *Eng. News-Rec.*, vol. 114, no. 24, June 13, 1935, pp. 836–838. Repair of rock-fill including removal and replacement of 75 per cent of old concrete facing that was cracked in settlement; dumping 60,000 cu yd of additional rock and reconstructing crest; method of removing original facing; facing dam with two plant units hauled up on incline cars.

FLOOD CONTROL

FLOODS, UNITED STATES. Kaw and Missouri Rivers Approached Record Crests in Recent Floods. *Eng. News-Rec.*, vol. 114, no. 24, June 13, 1935, pp. 859–860. Description of floods and data on high water in lower Missouri Valley streams during early part of June 1935; Missouri River damage; conditions in Nebraska; Colorado floods.

SNOW SURVEY. Snow Surveys as Aid to Flood Forecast and Control, J. E. Church. *Eng. News-Rec.*, vol. 114, no. 25, June 20, 1935, pp. 879–881. Reservoir regulation in interest of both flood control and water conservation facilitated by knowledge of snow concentration and melting rate; information needed as to effect of warm winds in increasing run-off; channel choking; reservoir reserve capacity; rise of Lake Tahoe in 1906–1907 and in 1927–1928.

FOUNDATIONS

BRIDGE PIERS. Danes Introduce New Caisson Practice at Little Belt Bridge, A. Engelund. *Eng. News-Rec.*, vol. 114, no. 24, June 13, 1935, pp. 841–845. Novel method of construction of caisson foundations for piers of steel bridge having spans up to 722 ft in length; caissons were equipped with walls of vertical pipes through which drill bits operate to sink cutting edges after working chamber, built bottom up for floating, is capsized in midstream for sinking.

GROUTING. Extensive Rock Grouting at Boulder Dam. *Eng. News-Rec.*, vol. 114, no. 23, June 6, 1935, pp. 795–797. Grouting in diversion and penstock tunnels as well as under dam, at pressures up to 1,000 lb per sq in., including complete grout curtain at abutments of dam; drill bits and pipe connection for grouting contact area between rock foundation and concrete of dam; relation of low-pressure grout and vent holes in tunnel lining.

OCCUPATIONAL DISEASES—CAISSON SICKNESS. Prevention of Compressed Air Sickness, H. Japp. *Structural Engr.*, vol. 13, no. 3, Mar. 1935, pp. 173–186. Methods of prevention; medical air locks as constant rate decompression valves; diagram showing rate of desaturation of blood after various periods of immersion in compressed air. Before Instn. Structural Engrs.

SETTLEMENT. Actual Factor of Safety in Foundations, K. von Terzaghi. *Structural Engr.*, vol. 13, no. 3, Mar. 1935, pp. 126–160. Settlement of foundations and effect of settlement on factor of safety of buildings; curves of equal settlement; curves of equal difference between measured and computed settlements. Before Instn. Structural Engrs.

HYDRAULIC ENGINEERING

MODELS. Use of Models in Hydraulic Engineering, A. H. Gibson. *Water & Water Eng.*, vol. 36, no. 442, Winter 1934, pp. 697–704, (discussion) 717 and 719–30. Mathematical principles of dynamical similarity; weir models; sluice gate models; siphon spillways; models of surge tank installations; river and tidal models; distortion of scale; bed materials. Bibliography. Before Instn. Water Engrs.

WATER FILTRATION PLANTS, DESIGN. Hydraulics of Rapid Sand Filters, G. G. Dixon. *Water Works and Sewerage*, vol. 82, no. 4, Apr. 1935, pp. 103–107. Optimum rate of wash; initial loss in filtration; loss of head in washing; examples of hydraulic losses in complete wash water systems. Bibliography.

HYDRO-ELECTRIC POWER PLANTS

FRANCE. L'aménagement du barrage-réservoir, et de la chute du Sautet sur le Drac, A. Robert. *Société Française des Electriciens—Bul.*, vol. 5, no. 52, Apr. 1935, pp. 391–412. Features of storage reservoir and concrete-arch dam, 126 m high, on Drac River in southeastern France; description of power house having annual output of 175,000,000 kw-hr.

PUMPED STORAGE. Das Pump-Speicherwerk zwischen Schwarz- und Weiss-Seein den Vogesen zur Spitzendeckung des Rheinkraftwerks Kembs, H. Blattner and H. Strickler. *Schweizerische Bauzeitung*, vol. 103, nos. 3, 4, 5, 7, and 11, Jan. 20, 1934, pp. 29–34; Jan. 27, pp. 41–45; Feb. 3, pp. 53–55; Feb. 17, pp. 77–80; and Mar. 17, pp. 130–132. Description of pumping installation and reinforced-concrete tunnel and pipe lines, up to 5.5 m in diameter, 1,100 m long, for pumping water storage from one reservoir to another, differing by about 110 m in elevation, to take care of peak loads of hydro-electric power plant.

WASHINGTON. Hydro-electric Power in Washington, C. E. Magnusson. *Univ. Wash.—Eng. Experiment Station—Bul.*, no. 78, Feb. 1935, 29 pp., 7 supp. plates. Engineering data of general interest on several proposed Grand Coulee dams; reservoir sites; potential water storage in Columbia River above Grand Coulee dam site; estimated cost data; irrigation by pumping; high dam vs. low dam at Grand Coulee.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

DUST STORMS. Dust Storms: Their Cause and Suggested Remedies, R. I. Throckmorton. *Eng. News-Rec.*, vol. 114, no. 19, May 9, 1935, pp. 669–671. Survey of causes of dust storms with special reference to wind erosion; drought and inadvisable farming methods; program of erosion prevention.

RAIN AND RAINFALL, DROUGHT. Frequency, Extent, and Severity of Droughts Since 1881, L. L. Harrold. *Eng. News-Rec.*, vol. 114, no. 14, Apr. 4, 1935, pp. 478–479. Statistical study of droughts in the United States with particular reference to 6 years of lowest precipitation, 1881–1934; areas affected by droughts since 1881; bunching of drought years.

INLAND WATERWAYS

RIVERS, GREAT BRITAIN. Flow of River Dee, W. N. McClean. *Water & Water Eng.*, vol. 36, no. 440, Nov. 1934, pp. 602–606, (discussion) 606–608. Review of plans for development and improvement of River Dee; progress of river survey for Dee; results obtained from records; correlation of water levels and river flows; flood flows; water level records. Before Brit. Assn.

RIVERS, IMPROVEMENT, MISSISSIPPI. Articulated Block Revetment Replaces Upper Bank Slabs. *Eng. News-Rec.*, vol. 114, no. 22, May 30, 1935, pp. 773–774. Construction of Leland Neck Cut-off revetment near Greenville, Miss., on Mississippi River, continuing underwater articulated-concrete-block mat construction to crest of river bank; overlap of revetment mats on curves is reduced by special slab arrangement.

RIVERS, IMPROVEMENT, RIO GRANDE. Removing Kinks from Rio Grande and Reducing Its Flood Menace. *Western Construction News*, vol. 10, no. 5, May 1935, pp. 121–123. Outline of $12,600,000 project for rectification of the Rio Grande along the Mexican boundary, including construction of the Caballo semi-hydraulic fill dam 60 ft high.

MATERIALS TESTING

CEMENT. Sampling and Testing Cement, P. J. Freeman. *Rock Products*, vol. 38, no. 3, Feb. 1934, pp. 44–47. Testing of type "B" cement used on Norris and Wheeler dams of Tennessee Valley Authority project; chemical compositions given, and summary of comparative results obtained by nine different laboratories; fineness determined by means of Wagner turbidimeter; necessary specifications quoted.

CONCRETE BEAMS. Austrian Fatigue Tests of Reinforced Concrete Beams, R. Saliger. *Eng. News-Rec.*, vol. 114, no. 20, May 16, 1935, p. 697. Abstract of report on preliminary tests of beams reinforced with four kinds of steel, ranging in ultimate strength from 121,000 to 62,000 lb per sq in. and in size from approximately 1-in. round to $^1/_2$-in. round; specimens were subjected to 1,000,000 to 3,000,000 load repetitions at rate of 160 to 170 per min; carrying capacity was not reduced by several million load changes; advantage of Isteg steel reinforcement.

HYDRO-ELECTRIC POWER PLANTS, CONSTRUCTION. Research Work in Relation to Albbruck-Dogern Hydro-electric Power Station on Rhine, H. E. Gruner. *Water and Water Eng.*, vol. 36, no. 442, Winter 1934, pp. 705–717, (discussion) 717 and 719–730. Report on foundation soil and concrete tests involved in construction of levee and power house; hydraulic tests of tail-race model for purpose of determining best shape for preventing silting.

ROAD MATERIALS, SPECIFICATIONS. Report of Committee D-4 on Road and Paving Materials. *Am. Soc. Testing Matls.—Advance Paper*, no. 59, mtg. June 24–28, 1935, 7 pp. Recommendations affecting standards; activities of subcommittees; proposed tentative method of test for determination of amount of material finer than No. 200 sieve in aggregates.

Stability of Granular Mixtures, D. S. Berry, *Am. Soc. Testing Matls.—Advance Paper*, no. 75, mtg., June 24–28, 1935, 17 pp. Investigation made as part of study being carried on by Michigan State Highway Department for purpose of developing rational method for design of surface and base courses for flexible type low-cost roads.

TILE, FLOOR. Abnutzungswiderstand von Steinfussboeden, D. W. Kessler. *Archiv fuer Technisches Messen*, vol. 4, no. 40, Oct. 31, 1934, pp. T, 134 (2 pp.). Wear resistance of tile floors; description of measuring equipment as used by U. S. Bureau of Standards.

PORTS AND MARITIME STRUCTURES

BREAKWATERS, HAWAIIAN ISLANDS. New Breakwater Protects Port Allen Harbor, J. B. Cox. *Excavating Engr.*, vol. 29, no. 5, May 1935, pp. 231–233 and 258–260. Construction of 1,200-ft breakwater in water from 25 to 36 ft deep, using rock from lava bed.

CARGO HANDLING, ACCIDENT PREVENTION. Accident Prevention in Small and Large Marine Operations, E. B. Tichenor. *Mar. Rev.*, vol. 165, no. 5, May 1935, pp. 27 and 40. Statistical data; primary causes of accidents; contributory causes analyzed.

MAINTENANCE AND REPAIR. Concrete Repairs on Ocean Pier, F. G. Lee and P. Jorgensen. *Eng. News-Rec.*, vol. 115, no. 1, July 4, 1935, pp. 1–6. Deterioration of Municipal Recreation Pier at St. Petersburg, Fla.—1,820 ft long—checked with aid of waterproofing, new expansion joints, and ingenious patching; details of new cross-girders under track trough constructed to provide for expansion joints; waterproofing of street-car track trough; financing and expenditures.

MARINE BORERS. Marine Borer Menace, R. H. Mann. *Man News*, vol. 22, no. 2, July 1935, pp. 18–19 and 23. Details concerning importance of shipworms, limnoria, wharfborers, and termites to users, owners, and constructors of waterfront structures and timber floating equipment.

QUAY WALLS. Ravier Hollow-Block Quay Wall. *Engineering*, vol. 139, no. 3822, June 14, 1935, pp. 620–621. Type of quay wall invented by Louis Ravier, Paris—adopted for work at ports of Djibouti, Bone and Arzew—who developed dumbbell or double Tee-headed type of block employed in tiers; blocks were cast on nearby wharf and transferred to site by means of floating derrick; cost data given.

SAN FRANCISCO. San Francisco Has One of World's Finest Harbors, H. O. Warren. *Mar. Rev.*, vol. 65, no. 5, May 1935, pp. 12–13 and 24. Brief historical review; statistical data; port equipment and facilities.

TERMINALS, MAINTENANCE AND REPAIR. Modernization of Maintenance Equipment Is Profitable, E. H. Philblad. *Mill & Factory*, vol. 16, no. 5, May 1935, pp. 77–80. Program of New York Dock Company.

ROADS AND STREETS

AERIAL SURVEYING. Aerial Surveys of Road Route from Rio Grande to Panama, D. T. Brown. *Eng. News-Rec.*, vol. 114, no. 22, May 30, 1935, pp. 768–769. Methods employed in aerial survey of portions of route for inter-American highway to Panama Canal.

ASPHALT. Producing Non-Skid Asphalt Surfaces, B. E. Gray. *Am. City*, vol. 50, no. 5, May 1935, pp. 80–82. Modern asphalt surfaces; surface treatments; road-mix and plant-mix surfaces; penetration macadam; block pavements. Before Highway Research Board.

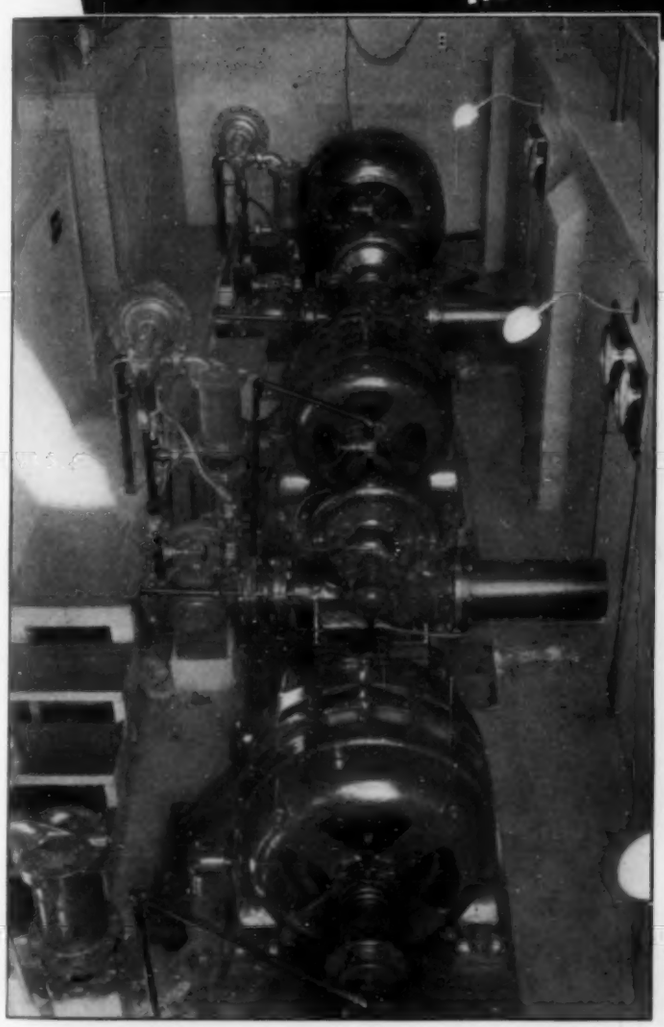
BELT. Der Berliner Reichsautobahnring, E. Gerlach. *VDI Zeit*, vol. 79, no. 7, Feb. 16, 1935, pp. 210–212. Belt highway around greater Berlin, totaling 180 km in length, to enable traffic between cities around Berlin to by-pass metropolitan district; types of intersections and junctions; saving in traveling time between points outside of Berlin due to by-passing by belt highway.

DESIGN. Highway Design for Speeds Up to 100 Miles Per Hour, R. H. Baldock. *Eng. News-Rec.*, vol. 114, no. 21, May 23, 1935, pp. 732–734. Analysis of curvature, sight distance, and superelevation from point of view of maximum safe speeds on new highways of Oregon, where main traffic arteries are designed for exceptionally high speeds; lengths of spirals required for critical speeds on curves up to 12 deg; sight distances required for safe passing at speeds of from 30 to 110 miles per hour.

EXCAVATION. Economical Operation of Excavators. *Engineering*, vol. 139, no. 3,615, Apr. 26, 1935, pp. 446–448. Comparison of characteristics of power shovel and dragline excavator; attempts that have been made to evolve formulas to give probable output of excavators under average working conditions; reference to investigations carried out by U. S. Bureau of Public Roads.

F-M CENTRIFUGAL PUMPS

PLAY STELLAR ROLE IN HIGH EFFICIENCY RECORD OF THE NEW BLOOMINGTON, ILL. MUNICIPAL PLANT



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HIGHWAY ENGINEERING, UNITED STATES. American Road Builders' Association. *Engineering*, vol. 139, no. 3615, Apr. 26, 1935, pp. 438–440. Brief review of papers read at January convention held in Washington, by H. G. Sours, H. J. Spelman, E. M. Fleming, C. N. Conner, and E. W. James, respectively.

HIGHWAY SYSTEMS, PAN AMERICAN. Rio Grande-Panama Highway Reported Practicable. *Eng. News-Rec.*, vol. 114, no. 22, May 30, 1935, pp. 766–768. Abstract of report made by U. S. Bureau of Public Roads, indicating that preferable route for isthmian section of Rio Grande-Panama highway is along the Continental Divide and in Pacific littoral; character of survey; line and construction standards; consolidated estimate of cost.

HISTORY. Early History of Streets and Paving of London, L. W. G. Malcolm. *Newcon Soc.—Trans.*, vol. 14, 1933–1934, pp. 83–91, (discussion) 91–94, supp. plates. Brief history of developments from Roman period up to era of macadam.

LOW COST. Low-Cost Roadbuilding, Symposium. *Eng. News-Rec.*, vol. 114, no. 26, June 27, 1935, pp. 905–910. Federal Secondary-Road Standards, C. N. Conner; Land-Service Roads for Sparse Population, G. D. Tramp; Oil-Mix Surfacing Methods and Costs, W. J. Slavin; Stabilized-Surface Methods and Costs, J. H. Barr; Bituminous Retread Surfaces, O. S. Hess; Stabilized Soil-Road Maintenance, H. G. Sours.

MACADAM. Cement Macadam Proves Adaptable to Unusual Construction Demands. *Eng. News-Rec.*, vol. 114, no. 24, June 13, 1935, pp. 845–849. Symposium consisting of two papers: Salvaged Sewage Filter Stone for Cement Macadam, W. Whipple; Intricate Construction Successful with Cement Macadam, F. W. Stopher.

MAINTENANCE AND REPAIR. Some of Problems of Surface Dressing, A. C. Hughes. *Instn. Mun. & County Engrs.—J.*, vol. 61, no. 16, Jan. 29, 1935, pp. 813–823 (discussion) 823–829. Purposes and methods of treatment; characteristics of gritting medium; scaling of chippings; aggregates available.

MARYLAND. Ten Years of Road Work Planned for Maryland. *Eng. News-Rec.*, vol. 114, no. 20, May 16, 1935, pp. 709–711. State planning commission specifies 906 miles of road, 60 bridges, and 57 crossings, in 10-year modernization program, and lays down governing principles.

RAILROAD CROSSINGS, ELIMINATION. Underpass at Detroit Rebuilt to Accommodate Wider Street. *Ry. Age*, vol. 98, no. 20, May 18, 1935, pp. 763–765. Project which concerns structure that carries tracks of Michigan Central and Grand Trunk Western over Woodward Avenue (U. S. 10) in Detroit, which was entirely rebuilt to accommodate widening of that busy artery of traffic from 74 ft (at crossing) to 120 ft.

ROADSIDE IMPROVEMENT. Practical Side of Roadside Development, W. H. Simonson. *Am. City*, vol. 50, no. 6, June 1935, pp. 57–58. Demand for improved appearance of roadside; highway as part of landscape; progress in roadside development; architectural improvement of roadside structures; landscape plantings, their work-relief value. Before 21st Annual Purdue Road School.

SALT STABILIZATION. Salt-Stabilized Road Practice Developing Rapidly. *Eng. News-Rec.*, vol. 115, no. 1, July 4, 1935, pp. 11–13. Experimental road construction, using salt as element for retaining moisture in stabilized soil mixture; theory of integral compounding and of salt modification of clay binder.

SUBSOILS. Soil Surveys for Highways in New Hampshire, J. O. Morton. *Eng. News-Rec.*, vol. 114, no. 20, May 16, 1935, pp. 706–709. Classification of soils and methods of recording soil profiles and presenting data for road design and construction in northern states; frost action; report form and sample report.

TURKEY. Road Construction in Turkey, W. Cramer. *Structural Engr.*, vol. 12, no. 9, Sept. 1934, pp. 398–402. Review of recent road construction in Turkey, with special reference to road drainage, highway bridges, and protective sheds against avalanches.

SEWERAGE AND SEWAGE DISPOSAL

CHEMICAL PROCESS. Chemical Precipitation of Sewage, E. W. Steel and P. J. A. Zeller. *Am. City*, vol. 50, no. 6, June 1935, pp. 48–50. Reason for revival of interest in sewage disposal by chemical precipitation; ferric salts as coagulants; special studies at Dallas, Tex.; cost of treatment. Bibliography.

GENEVA, ILL. Geneva Sewage Treatment Works, E. R. Wells. *Water Works & Sewerage*, vol. 82, no. 5, May 1935, pp. 167–168. Description of new gas recovery sewage disposal plant of Geneva, Ill., built with park surroundings to serve population of 8,500; operating results.

NEW JERSEY. Meeting of N. J. Sewage Works Association. *Water Works and Sewerage*, vol. 82, no. 4, Apr. 1935, pp. 120–126. Proceedings of 1935 annual meeting of New Jersey Sewage Works Assn. including abstracts of following papers: Spray Drying of Sewage Sludge, C. L. Riley; New Activated Sludge Plant of Bernardsville, N.J., W. Gavett; Consideration of Some Elements in Formulation of Pollution Control of Streams, J. K. Hoskins; Experimental Work on Sedimentation, H. N. Lendall; Explosion Hazards in Sewers—Causes and Methods of Prevention, E. T. Killam and M. H. Klegerman; Sewage Treatment Chemicals—Their Use and Abuse, J. M. Potter; Notes on Experimental Work of N. J. Sewage Experimental Station, W. Rudolfs; Results of Survey and Study of Performance of Sprinkling Filters, L. Forman. Advances of Separate Sludge Digestion, and Its Relationship to Newer Trends, A. W. Darby; Experimental Findings on Coagulation and Sedimentation of Sewage Solids with Iron Salts, W. H. Baumgartner; Combined Disposal of Garbage and Sewage, M. M. Cohn.

PAPER AND PULP MILLS. Die Abwasser der Zellstoff- und Papierindustrie, Steinschneider. *Gesundheits-Ingenieur*, vol. 57, no. 47, Nov. 24, 1934, pp. 638–640. Characteristics and classification of sewage and waste from cellulose plants and paper mills; methods of treatment and utilization. Before German Soc. of Construction Engrs.

PLANTS, CANAJOHARIE, N.Y. Combined Wastes Disposal Plant. *Am. City*, vol. 50, no. 5, May 1935, pp. 72–73. Features of Canajoharie, N.Y., plant for treatment of sewage and incineration of garbage; completed work cost $55,000.

SANITARY ENGINEERING, GERMANY. Die deutschen Abwassergenossenschaften, Imhoff. *Gesundheits-Ingenieur*, vol. 57, no. 48, Dec. 1, 1934, pp. 649–650. Organization of and statistical data on 10 sanitary districts of Germany beginning with Emschergenossenschaft, Essen, founded in 1904.

SEWERS, CONSTRUCTION. Long Intercepting Sewer Built Through Bad Ground. *Eng. News-Rec.*, vol. 114, no. 22, May 30, 1935, pp. 775–777. Construction of reinforced-concrete interceptor, 10 miles long, 48 to 54 in. in diameter at Cumberland, Md., carried in canal bed on stone base over mud bottom, retained by permanent sheeting; special concrete pipe joints with bituminous filler applied from outside designed to prevent infiltration through canal section; special foundations through stretch of soft ground in canal bed; pipe plant.

SEWERS, DESIGN. Some Aspects of Sewer Design, A. S. Knolles. *Instn. Mun. & County Engrs.—J.*, vol. 61, no. 14, Jan. 1, 1935, pp. 725–738, (discussion) 739–745. Requirements of separate and combined systems; velocity in 6, 9, 12, and 18-in. circular sewers and concrete sewers of ovoid section; importance of storage capacity.

STRUCTURAL ENGINEERING

BEAMS, TORSION. Structural Beams in Torsion, I. Lyse and B. Johnston. Mimeographed copy. 1934, 72 pp., figs., diagrs., charts, tables, supp. plates. Results of 2 years' study, at Fritz Engineering Laboratory, of torsional properties of standard steel beams for design of members subjected to torsional loads; evaluation of torsion constant for standard H and I sections by application of "membrane analogy" to 60 sections of widely varying flange, web, and fillet proportions; effect of end fixity; formulas checked by tests.

CONCRETE BEAMS. Why Continuous Frames? H. Cross. *Am. Concrete Inst.—J.*, vol. 6, no. 4, Mar.–Apr. 1935, pp. 358–367. Advantages and disadvantages of continuous designs, with special reference to concrete construction; study of rigid frame; quasi-hinges; deformation strains; rigid-frame buildings; economy from redistributing dead load; ordinary building frames.

CONCRETE TANKS. Shrinkage Cracks in Reinforced Concrete Tanks, G. P. Manning. *Concrete & Constr. Eng.*, vol. 30, no. 5, May 1935, pp. 271–278. Observed phenomena in tanks; assumed coefficients of shrinkage, elasticity, etc., for approximate calculations; theoretical aspect of shrinkage in walls, and in tank roofs; possible remedies for temperature-shrinkage and for time-shrinkage cracks.

EARTHQUAKE EFFECT. Earthquake Resistance of Structures, C. W. Hamann. *Structural Engr.*, vol. 12, no. 12, Dec. 1934, pp. 492–507. Survey of problems presented to engineer by earthquake shocks; causes of earthquakes; effects of earthquakes on structures; resistance to shocks. Before Instn. Structural Engrs.

RIGID-FRAME STRUCTURES. Rigid-Frame Design in Bureau of Yards and Docks, G. A. Hunt. *Eng. News-Rec.*, vol. 114, no. 26, June 27, 1935, pp. 915–917. Theoretical mathematical discussion; design charts for obtaining moment coefficients for unloaded and for loaded spans; numerical example.

WELDED ROOF TRUSSES. Welded Construction, C. Helsby. *Structural Engr.*, vol. 13, no. 3, Mar. 1935, pp. 162–172. Methods of fabricating and welding of steel roof trusses. Before Instn. Structural Engrs.

TUNNELS

SEWER TUNNELS, CHICAGO. Concrete-Placing Methods on Chicago Sewer Tunnels—III. *Eng. News-Rec.*, vol. 114, no. 26, June 27, 1935, pp. 911–914. Form design; filling forms; mixing plants; top plant and shafts; shaft equipment; ventilation.

Sewer Tunnels Reduce Pollution in Chicago Drainage Canal. *Eng. News-Rec.*, vol. 114, no. 24, June 13, 1935, pp. 831–835. First of three articles describing extensive intercepting sewer program involving 27.2 miles of tunnels from 4 to 17 ft in diameter, driven through all kinds of ground to serve West Side and Calumet treatment plants; design of tunnels; siphon river crossings; concrete specifications.

SUPPLY TUNNELS. Soft Ground and Lining Work on Owyhee Project Tunnels. *Eng. News-Rec.*, vol. 114, no. 23, June 6, 1935, pp. 804–807. Construction of concrete-lined irrigation water tunnels No. 5 and No. 1: 4½ and 2½ miles long; 11 ft circular and 16 ft 7 in. horseshoe, respectively; adverse geological conditions resulted in need for careful unwatering, advance grouting, and steel-plate lining; use of mucking machines.

VEHICULAR, NEW YORK. Midtown Hudson Tunnel, C. H. Vivian. *Compressed Air Mag.*, vol. 40, no. 4, Apr. 1935, pp. 4702–4707. Description of shield method of construction of 39th Street tunnel under Hudson River; 6,070 ft long; usable section will be 21.5 ft wide and 13.75 ft high; ventilation provisions.

WATER SUPPLY TUNNELS, CONSTRUCTION. Diversion-Tunnel Driving at Fort Peck Dam. *Eng. News-Rec.*, vol. 114, no. 21, May 23, 1935, pp. 735–738. Construction of four parallel, circular, concrete-lined tunnels, having lined diameter of 26 ft and averaging 6,317 ft in length; rock conditions; pilot tunneling methods; conveyor spoil disposal; concreting plant and methods.

WATER PIPE LINES

LEAKAGE. How Over 100 Million Gallons a Day Leaking from New York City Water Supply System Has Been Stopped, F. B. Nelson. *Mun. Engrs. J.*, vol. 21, first quarterly issue 1935, pp. 19–45 (discussion), 45–56. Cycles of supply and consumption demands; subsurface conditions as affecting leakage; amount of water saved as basis of calculation; costs and results of complaint work; evident and non-evident leaks; special systematic surveys; results in lower Manhattan; night use; calculation of amount of leakage.

WATER TREATMENT

OPERATION OF PLANTS. Money Saving Methods in Purification Plant Operation, W. H. Lovejoy. *Water Works & Sewerage*, vol. 82, no. 5, May 1935, pp. 169–171. Operation of water treatment plant of Louisville, Ky.; savings made on reconstruction jobs; using local sand in filters; improved methods of cleaning basins; savings due to change from small to large chlorine containers, to substitution of quicklime for hydrated lime, and to installation of flocculators.

PURIFICATION, ACTIVATED CARBON. Behavior of Oxidizing Agents with Activated Carbon, A. S. Behrman and H. Gustafson. *Indus. & Eng. Chem.*, vol. 27, no. 4, Apr. 1935, pp. 426–429. Purpose of paper is to point out that chemical reaction of carbon and free chlorine, employed in one method of water treatment, is not isolated phenomenon, but is in agreement with theory of behavior that was worked out several years ago. Bibliography.

WATER WORKS ENGINEERING

GREAT BRITAIN. Latton Water Scheme 1931, F. H. Coleby. *Instn. Mun. & County Engrs.—J.*, vol. 61, no. 25, June 4, 1935, pp. 1387–1393. Details of equipment and main.

UNITED STATES. A.W.W.A. Convention at Cincinnati an Outstanding One. *Water Works & Sewerage*, vol. 82, no. 5, May 1935, pp. 181–185. Proceedings of 1936 convention of American Water Works Assn., including abstracts of following papers: Deficiencies in Present Water Resources Information, T. Saville; Current Situation in Public Works Program, M. Pirnie; Future Growth of American Cities, C. A. Dykstra; etc.

Nation's Water Problems Discussed by Waterworks Men. *Eng. News-Rec.*, vol. 114, no. 20, May 16, 1935, pp. 713–716. Proceedings of 1935 convention of American Water Works Assn., including abstracts of papers and discussions on droughts, long-range planning, public-works program, water purification, pipe corrosion, cast-iron pipe, specifications, California dams, and finance and accounting.

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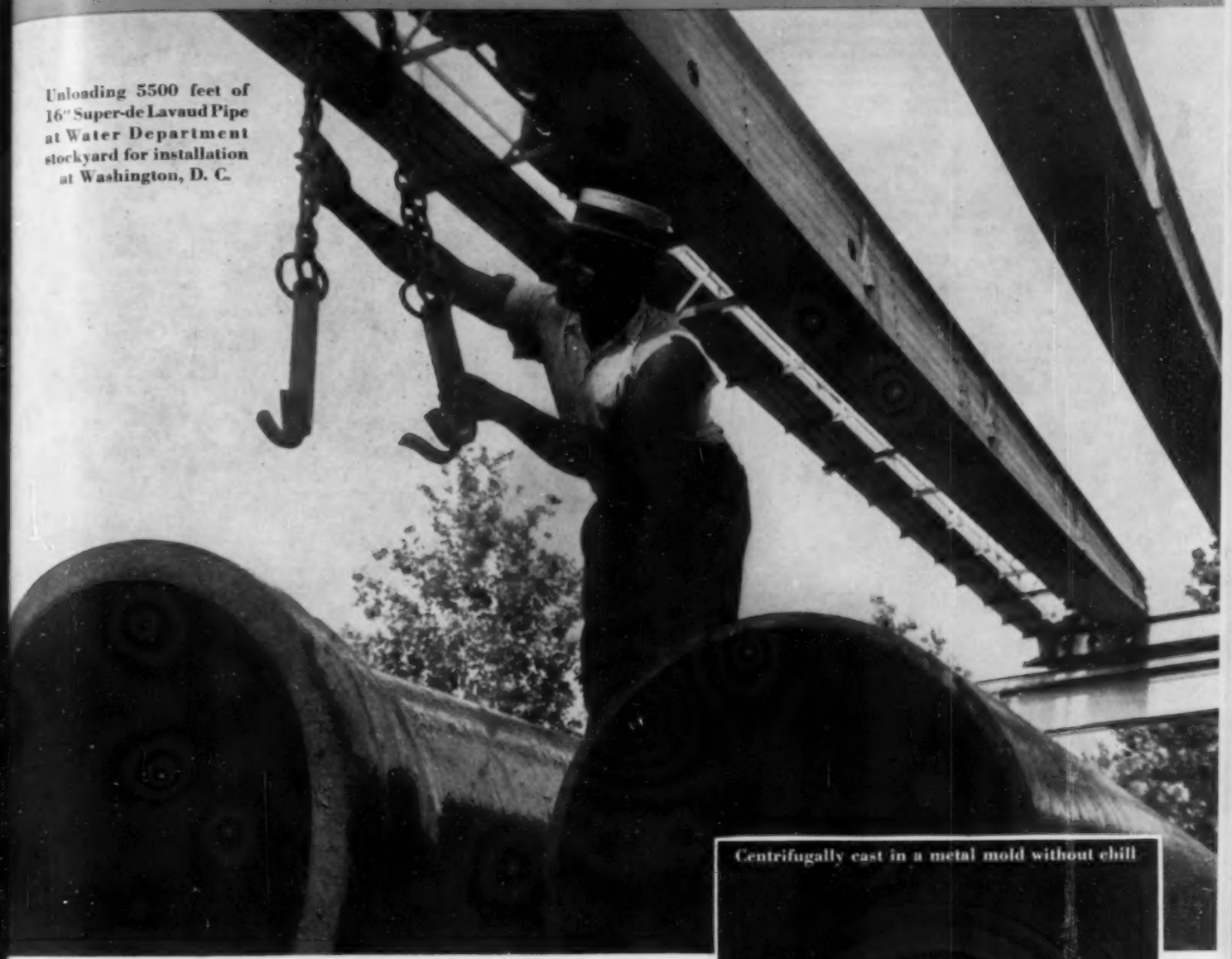

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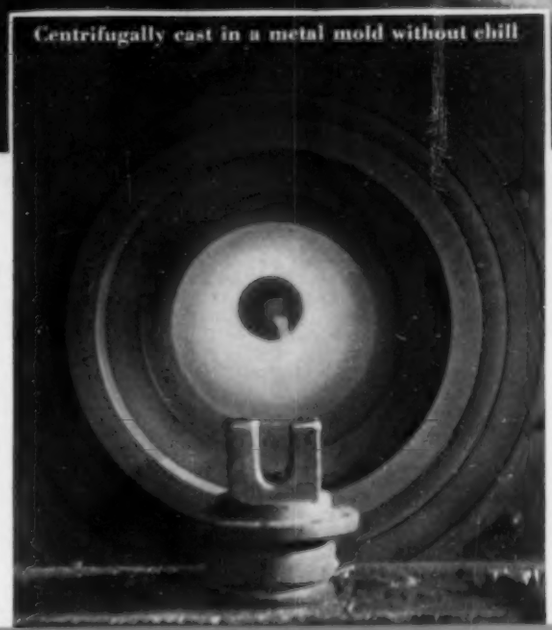

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CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; married; B.S. in C.E., California Institute of Technology, 1933; 2 months geodetic surveying, University of Michigan (Camp Davis); 9 months scientific aide U. S. Department of Agriculture; 1 year exploitation engineering—field trainer; 1 year junior exploitation in production research problems. Speaks German, French, Dutch fluently. Desires opportunity any branch of engineering. Location immaterial. Available. D-4287.

GRADUATE CIVIL ENGINEER: Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Iowa State College, 1934; registered professional engineer, Minnesota and Iowa; 4 years experience as assistant to county engineer. Chief interests: highways, geodesy, municipal, and structures. Type of work and salary secondary. Available immediately. Location in Hawaiian or Philippine Islands desired. D-3689.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 22; single; B.S. in C.E., New York University, 1934; majored in sanitary engineering; desires position as engineering apprentice or junior engineer in any branch of civil engineering, or as statistician. Location immaterial. Available immediately. D-3870.

ENGINEER; Jun. Am. Soc. C.E.; 23; married; B.S. in C.E.; majored irrigation, drainage; 6 months office, field assistant, on drainage and irrigation investigations; 1½ months assistant chief of party, U. S. Coast and Geodetic Survey; 1½ months assistant in design of municipal water system; 3 months draftsman; 9 months junior topographic engineer, on leveling and drafting. Desires position any branch civil engineering. D-4139.

JUNIOR CIVIL ENGINEER; Jun. Am. Soc. C.E.; 21; single; B.S. in C.E. (cum laude), New York University, 1934; 5 months experience in mechanical drafting. Desires position in any field of civil engineering, preferably structural or highway, or with engineering periodical. Location and salary secondary. D-3775.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single; B.S. in C.E., Newark College of Engineering; 1½ years as draftsman; limited experience in surveying. Desires opportunity in any branch of civil engineering. Available immediately. Location immaterial. D-3792.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; married; B.S. in C.E., Newark College of Engineering; 14 months municipal experience, surveying, drafting, inspecting; 2½ years draftsman and computer, U. S. Coast and Geodetic Survey; chief interests along mathematical and statistical lines. Available immediately. Location eastern United States. D-885.

SALES

CIVIL AND ARCHITECTURAL ENGINEER; Jun. Am. Soc. C.E.; 29; single; desires connection with sales organization; graduate licensed professional engineer and land surveyor; 8 years progressive professional experience in municipal consulting engineering and construction work; administration; design; drafting; supervision; inspection; surveys; sales and promotion work. Location immaterial. D-4152.

TEACHING

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; B.S. in C.E., Armour Institute of Technology, 1932; M.S. in C.E., California Institute of Technology, 1933; 9 months experience as structural engineer. Recent graduate work in aerodynamics, theory of elasticity, geology, soil mechanics, including eight months teaching engineering drawing. Research work in sanitation and advanced theory of structures. D-4037.

GRADUATE CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; age 33; C.E., M.S., D.Sc. in engineering; 10 years experience in design and erection of bridges and buildings. Also teaching experience. Well versed in statically indeterminate structures, elasticity, advanced mechanics. Desires position teaching structural engineering, applied mechanics, or civil engineering subjects. Available September 1935. D-1860.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ATM. ARCHIV FÜR TECHNISCHES MESSEN, Lieferungen 45–49, March-July 1935. Munich and Berlin, R. Oldenbourg, 1935. Illus., diagrs., charts, tables, 12 × 9 in., paper, 1.50 rm. each.

The text of this work consists of brief reviews of new developments in the field of measurement, reports upon individual methods of measurement, and descriptions of new methods of research. The articles are classified and punched for loose-leaf binders, so that they can be arranged for easy reference.

BERICHT ÜBER DIE KORROSIONSTAGUNG 1934 am 20 November 1934 in Düsseldorf. Prepared by Verein deutscher Eisenhüttenleute, Verein deutscher Chemiker, Deutsche Gesellschaft für Metallkunde, Verein deutscher Ingenieure. Berlin, VDI-Verlag, 1935. 76 pp., illus., diagrs., charts, tables, 8 × 6 in., paper, 5 rm.

This conference was devoted to reports upon our knowledge of pipe corrosion and of methods of preventing it. The action of water, aqueous solutions, and earth upon metals, internal corrosion in water and gas mains, corrosion in hot-water containers, and other related subjects were discussed by specialists.

BUILDING SUPERINTENDENCE. By C. E. White. Scranton, Pa., International Textbook Co., 1935. Illus., charts, diagrs., tables, blueprints, 8 × 5 in., $3.50.

This volume is intended for the young architect or architects' superintendent. The method of superintending the construction of buildings is described clearly, step by step, and illustrated by application to a building.

CHEMISTRY OF CEMENT AND CONCRETE. By F. M. Lea and C. H. Desch. London, Edward Arnold & Co.; New York, Longmans, Green & Co., 1935. 429 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $9.50.

A general survey of the subject for the use of chemists and engineers. The chemistry of the changes which the raw materials undergo during cement making, the constitution of cements, the nature and properties of the compounds they contain, and the properties of set cements and their hydrated constituents are discussed comprehensively. Chapters are devoted to pozzuolanic, slag, aluminous, and other cements, to concrete aggregates, to the resistance of cement to destructive agencies, and to the examination of concrete failures.

ELEMENTARY STRUCTURAL PROBLEMS IN STEEL AND TIMBER. By C. R. Young. 2 ed. New York, John Wiley & Sons, 1935. 315 pp., diagrs., tables, charts, 9 × 6 in., leather, $4.

This volume is intended to supplement treatises on the theory of structures by providing a collection of problems. The book includes examples of practically all the elementary problems met by the structural engineer, and the rules of procedure and the methods of applying formulas for their solution are illustrated clearly and concisely. Numerous problems for solution are included. The new edition has been thoroughly revised.

FORMS AND CENTERING. By A. B. MacMillan. Scranton, Pa., International Textbook Co., 1934. Illus., diagrs., 8 × 5 in., leather, $1.50.

This simple, practical text covers the construction of forms for concrete walls, columns, floors, dams, bridges, and other structures.

FORSCHUNGSHEFT 372. MODELLVERSUCHE ÜBER SPANNUNGSVERTEILUNG UND FORMÄNDERUNG IM BERGBAU. By K. Lehr and K. Seidl. Berlin, VDI-Verlag, 1935. 33 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 5 rm.

This bulletin reports the results of two important investigations of the distribution of stresses in mines, caused by earth pressure. By means of models, the stresses around rooms and in roofs were investigated. The work was carried out by the Research Division of the Verein deutscher Ingenieure, and is an interesting application of model experimentation in a new field.

MITTEILUNGEN DES FORSCHUNGS-INSTITUTES FÜR WASSERBAU UND WASSERKRAFT E. V. MÜNCHEN DER KAISER-WILHELM-GESELLSCHAFT ZUR FÖRDERUNG DER WISSENSCHAFTEN, Heft 3, 1935. Munich and Berlin, R. Oldenbourg, 1935. 52 pp., illus., diagrs., charts, tables, 11 × 8 in., paper, 3.20 m.

This communication from the Research Institute for Hydraulics contains two reports. The first, by B. Esterer, describes a photo-electric process for analyzing sludges and slimes, which permits the determination of the sizes of the solid particles, as well as their quantity. The application of the process for determining the amount and character of the suspended material in streams is described. The second report, by Dr. H. Schröter, gives a systematic report of the investigations of cavitation as a cause of corrosion, which have been in progress for several years at Walchensee.

MITTEILUNGEN DES FORSCHUNGS-INSTITUTES FÜR WASSERBAU UND WASSERKRAFT E. V. MÜNCHEN DER KAISER-WILHELM-GESELLSCHAFT ZUR FÖRDERUNG DER WISSENSCHAFTEN, Heft 4, 1935. Munich and Berlin, R. Oldenbourg, 1935. 54 pp., illus., diagrs., charts, tables, 11 × 8 in., paper, 3.20 m.

This report considers the use of wire netting in the construction of revetments, upon the basis of experience with it in southern Germany and Austria. The advantages and disadvantages are discussed, the questions of corrosion and erosion are studied, and rules for its use are formulated.

PUBLIC UTILITY QUESTION. By H. G. Hendricks. Published by author at 5629 Kansas Ave., Washington, D.C.; on sale American News Co., 131 Varick St., New York, N.Y., 1935. 148 pp., tables, 8 × 5 in., cloth, $2.

The part played by the holding company in the public utility industry is discussed by a former member of the staff of the House Committee on Interstate and Foreign Commerce. The general features of the utility industry, control, financial structures, the iniquities of holding companies, service institutions, and the political attack on the utilities are treated. The material, which is taken largely from government reports, is presented impartially.

SURVEYING. By H. Bouchard. Scranton, Pa., International Textbook Co., 1935. 586 pp., illus., diagrs., charts, tables, 8 × 5 in., leather, $3.75.

This book is intended as a text for students and a reference book for engineers and surveyors. It covers the topics usually met in surveying practice and also includes basic information about public land surveying, earthwork, curves, aerial photographic surveying, and similar features. Special attention is paid to the sources of error in field operation and their correction. The text is clear and concise.

ZWEI JAHRE ARBEIT AN DER REICHSAUTOBAHN ZUR ERÖFFNUNG DER ERSTEN TEILSTRECKEN HERAUSGEGEBEN VON DER GESELLSCHAFT "REICHSAUTOBAHNEN" IM EINVERNEHMEN MIT DEM GENERALINSPEKTOR FÜR DAS DEUTSCHE STRASSENWESEN UND DEM REICHSMINISTER FÜR VOLKSAUFKLÄRUNG UND PROPAGANDA. Berlin, Volk und Reich Verlag, 1935. 84 pp., illus., maps, 10 × 9 in., paper, 3.50 rm.

An interesting collection of photographs, maps, and charts describing the results so far obtained in the construction of the new automobile highway system of Germany. The books celebrate the opening of the first section of the system.

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BRIDGES

ARCH, INDIANA. Iron-Plate Arch Reduces Load of Marshland Bridge. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, p. 41. Construction of highway bridge, near Syracuse, Ind., consisting of corrugated-iron arch; length of span 22.5 ft.; rise 9 ft 2 in.; 25 ft wide; spandrel walls also made of metal.

CONCRETE, DESIGN. Can Quantities in Concrete Bridges Be Estimated from Diagram? E. L. Heidenreich. *Concrete*, vol. 43, no. 2, Feb. 1935, p. 23. Author suggests method for developing diagrams which can be used to determine within close limits quantities of materials in reinforced concrete bridges, in advance of design; idea suggested by Waddell's new charts for steel bridge quantities.

Design of Credit River Bridge, A. Sedgwick. *Can. Engr.*, vol. 67, no. 22, Nov. 27, 1934, pp. 5–8. Design of Credit River bridge between Toronto and Hamilton, Ontario, consisting of four arch-rib spans; 155 ft center to center of piers; one westerly approach span, 70 ft long, and two easterly approach spans with combined length of 113 ft; main arch rise of 56 ft; twin spandrel columns; working stresses; steel guard rails; flumes to drain approaches; timber piling failed.

RAILROAD. Railroads Complete Long Bridges Over Bonnet Carré Floodway. *Ry. Age*, vol. 99, no. 1, July 6, 1935, pp. 3–7. Unusual problems presented in design and construction of three trestles that carry 7.8 miles of tracks.

STEEL CONSTRUCTION, AUSTRIA. Zur Entwicklung des Stahlbaues, F. Zelisko. *Montanistische Rundschau*, vol. 27, no. 4, Feb. 16, 1935, (*Stahlbau Technik*) pp. 1–5. Development of steel construction in Austria; description and illustrations of recent bridge and viaduct constructions, car sheds, etc.

STEEL TRUSS, EGYPT. New Khedive Ismail Bridge, Cairo, Egypt, F. W. Stephen. *Instn. Civ. Engrs.—Min. Proc.*, vol. 240, pt. 2, no. 4,987, 1935, 31 pp. 1 supp. sheet. Design and construction of Nile River bridge consisting of eight spans totaling 382.2 m in length and including swing span providing two 20-m openings for navigation; width of bridge 20 m; details of caisson construction and erection of superstructures.

SUSPENSION, TOWERS, ERECTION. Hammerhead Derricks Erect Steel Towers of Bay Bridge, H. C. Hunter. *Eng. News-Rec.*, vol. 114, no. 25, June 20, 1935, pp. 867–870. Features of design; make-up and dimensions for 500-ft towers of San Francisco Bay bridges; erection procedure; moving of derrick.

WOODEN, CONSTRUCTION. Trestle Panel Planking, P. M. Schmook. *Timberman*, vol. 36, no. 9, July 1935, p. 26. Brief note on place of wood in permanent bridge construction.

BUILDINGS

APARTMENT HOUSES, GREAT BRITAIN. Modern Methods of Flat Construction, F. S. Snow. *Structural Engr.*, vol. 13, no. 5, May 1935, pp. 230–245. British methods of housing construction, adopted in construction of 10 blocks of 320 industrial dwellings in Hackney, and one block of 21 dwellings at Stepney; concrete costs (labor only) in man-hours; progress charts. Before Instn. Structural Engrs.

EARTHQUAKE RESISTANCE. Design Earthquake-Proof Buildings by Attention to Details, J. J. Creskoff. *Concrete*, vol. 43, no. 2, Feb. 1935, pp. 21–22. Post Office building at Redwood City, Calif., complies with fundamental principles; monolithic superstructure on reinforced concrete mat; causes of collapse; details of earthquake-proof design.

CITY AND REGIONAL PLANNING

SLUMS. Slums and Blighted Areas in United States, E. E. Wood. *Federal Emergency Administration Pub. Works—Housing Division Bul.*, no. 1, 1935, 126 pp., 7 supp. sheets. Slum clearance and rehousing of low-income groups; origin of slums; economic effects of slums and blight; housing conditions in large cities of United States; conditions shown in real property inventory of 1934; beneficial results of slum clearance and rehousing; partial list of housing surveys in the United States.

CONCRETE

CEMENT, BLEEDING. Bleeding of Cements, L. S. Brown. *Indus. & Eng. Chem.*, vol. 27, no. 1, Jan. 1935, pp. 97–102. Experimental study of tendency of water to rise to top of concrete soon after it has been placed; relationship between bleeding tendency of various normal and poly-purpose cements and water gain under aggregate in concretes made from them; elimination of water gain.

CONSTRUCTION. Concrete—Yesterday, Today, Tomorrow, W. J. Mehren. *Am. Concrete Inst.—J.*, vol. 6, no. 4, Mar.–Apr. 1935, pp. 345–357. General review of progress in design and construction of concrete structures; control devices; progress in cement; change in composition; improving of good qualities; future market.

CONSTRUCTION, PUMP PLACING. Pumping Concrete for Tunnel Lining on Aqueduct. *Western Construction News*, vol. 10, no. 6, June 1935, pp. 151–153. Specially designed unit for lining 16-ft tunnel of Colorado River Aqueduct, consisting of mixer, charging device, and pump mounted on 36-in. gage trucks with 24-ft wheelbase; continuous output at rate of 30 cu yd per hr; concrete placing methods; pumpcreting operations; crews required for lining.

CONSTRUCTION, SPECIFICATIONS. Some Observations on New Code of Practice for Reinforced Concrete, C. E. Reynolds. *Structural Engr.*, vol. 12, no. 12, Dec. 1934, pp. 478–489. Comments on provisions concerning stresses, mixes, and loads, design of slabs, and columns. Before Instn. Structural Engrs.

PERMEABILITY. Investigation of Permeability of Mass Concrete with Particular Reference to Boulder Dam, A. Ruettgers, E. N. Vidal, and S. P. Wing. *Am. Concrete Inst.—J.*, vol. 6, no. 4, Mar.–Apr. 1935, pp. 382–416. Research by U. S. Bureau of Reclamation in connection with Boulder Dam; permeability apparatus, tests and experimental errors; effect of varying pressure and length of cure; variation of permeability with water-cement ratio and maximum size of aggregate; dissolution curves for cement; practical applications of permeability tests.

PROPERTIES. Physical Properties of Speed Portland and Blended Cement Mortars and Concretes, R. E. Mills and R. B. Crepps. *Purdue Univ. Eng. Bul.—Research Series*, no. 47, vol. 18, no. 5, Sept. 1934, 60 pp. Investigation by Engineering Experiment Station of Purdue University and Louisville Cement Company on blend of three volumes of normal speed portland cement with one volume of Louisville natural cement; plastic flow in concrete cylinders; fatigue endurance of cement-mortar beams; expansion and contraction of mortar beams; freezing and thawing tests.

CONSTRUCTION INDUSTRY

COSTS. Current Construction Unit Prices. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, p. 70. Unit costs bid on construction of Kentucky roads in 1934 and 1935, also on construction of 8-ft concrete-gravity dam near Dover, Ohio.

DAMS

CONCRETE ARCH, DESIGNS. Trial Load Analyses of Curved Concrete Dams, I. E. Houk. *Engineer*, vol. 160, nos. 4147 and 4148, July 5, 1935, pp. 2–5, and July 12, pp. 28–31 and 40. Basis of trial-load method; calculations; effects included in analyses; trial-load analyses in arch dam design; dams designed by trial-load methods.

CONCRETE GRAVITY, WASHINGTON. Second Report of Columbia Basin Commission of State of Washington from December 19, 1933, to January 1, 1935, Olympia, Washington, 1935, 71 pp., figs. Statement of activities, expenditures, and developments in promotion of construction and development of Columbia Basin Project; progress in construction of Grand Coulée dam and reservoir.

RAILROAD TRACKS, RELOCATION. Two Railroads Make Way for Bonneville Dam. *Ry. Age*, vol. 99, no. 7, Aug. 17, 1935, pp. 206–209. Description of extensive revisions of grades and alinements on sections of Spokane, Portland & Seattle and Oregon–Washington Railroad & Navigation Co., which are affected by Columbia River Project.

FLOOD CONTROL

MINES AND MINING. Tri-State Flood Control Cuts Mine Pumping, E. W. McCuskey. *Eng. & Min. J.*, vol. 136, no. 7, July 1935, pp. 319–322. Review of work done by U. S. Geological Survey in vicinity of Picher, Okla., and Baxter Springs, Kans.; measures to keep surface water and flow from abandoned wells out of underground workings are proving effective; illustrations, statistical data, and descriptive matter.

NEW YORK. Heavy Rains in Western New York State Cause Worst Flood in Seventy Years. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, pp. 65–66. Report on heavy rainfall and catastrophic floods of July 7 and 8, 1935, centering about Ithaca, N.Y.; damage estimated at $10,000,000; rainfall amounted in some points to over 9 in. in 15 hr.

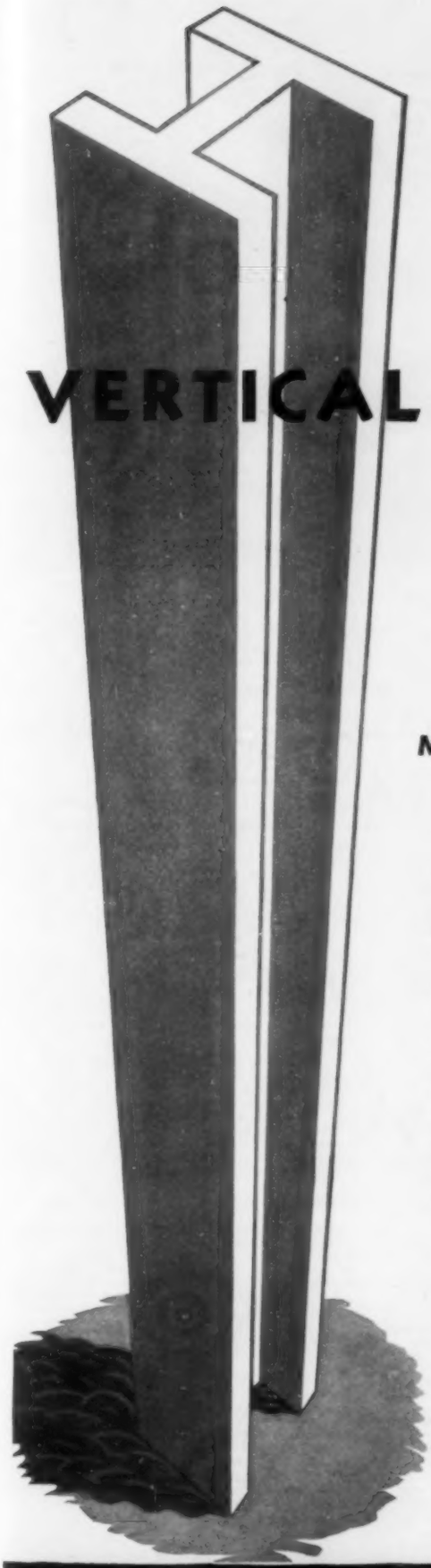
PROTECTION. Protection Against Floods, J. E. Holmstrom. *Instn. Mun. & County Engrs.—J.*, vol. 61, nos. 17 and 18, Feb. 12, 1935, pp. 865–867, and Feb. 26, pp. 913–920. Principles that should govern consideration of schemes for protecting land against damage due to floods. Bibliography.

FLOW OF FLUIDS

PITOMETERS. Messung der Foerdermenge einer Pumpenanlage mittels der "Staukugel," J. Lalive. *Schweizerische Bauzeitung*, vol. 105, no. 8, Feb. 23, 1935, pp. 83–85. Measurement of discharge of Egyptian drainage pumping plant by gaging with recently invented spherical pitometer or pitot-sphere provided with five apertures; method of plotting flow through pipe line from spherical pitometer readings.

FOUNDATIONS

CAISSONS, STEEL, ROTATING. Rotating Foundation Caissons Drill Their Way to Rock. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, pp. 37–41. Construction of foundation for new federal office building in lower Manhattan, New York City; cylinders from 4 to 8½ ft in diameter and averaging 66 ft in length spun through virgin soil while high-pressure revolving jets excavate most of contents of shell during sinking operation; sinking progress runs between 12 and 20 ft per hr; details of welded tower and bedframe carrying 3-drum hoist and rotor assembly.



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COFFERDAMS. Cofferdam for 60-Ft Head with One Line of Sheeting. N. F. Helmers. *Eng. News-Rec.*, vol. 115, no. 1, July 4, 1935, pp. 14–15. Construction of 68 by 36-ft cofferdam for bascule pier of Cowlitz River bridge, in Washington; single line of steel sheetpiles put to about limit of resistance by deep water and volcanic sand pressures.

SOILS, PHYSICS. Soils Mechanics Education Takes Step Ahead. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, p. 45. Abstracts of papers on soil mechanics before annual meeting of Society for Promotion of Engineering Education, including following: Research in Foundation Pressures, W. S. Housel; Recent Developments in Soil Mechanics, A. Casagrande; Practical Soil Mechanics Laboratory, R. R. Philippe; Use of Models in Soil Mechanics, D. P. Krynine; Undergraduate Courses in Soil Mechanics, D. M. Burmister; Graduate Courses in Soil Mechanics, L. Tucker.

HYDRO-ELECTRIC POWER PLANTS

BOULDER DAM PROJECT, HYDRAULIC TURBINES. Construction of 115,000-hp Boulder Dam Turbines. W. M. White. *Mech. Eng.*, vol. 57, no. 9, Sept. 1935, pp. 539–546. 15 units, each with 115,000-hp capacity; two units, each with 55,000-hp capacity; to develop full capacity at 475-ft head; guaranteed to develop 90,000 hp under operating head of 420 ft; speed 180 rpm; comparison of size of these turbines with others in operation.

COLUMBIA RIVER. Progress at Bonneville. *Eng. News-Rec.*, vol. 115, no. 1, July 4, 1935, pp. 16–18. Plans for passing streamflow of 700,000 cu ft per sec; earth cofferdams at power house may be partly removed and replaced; temporary lock gate; fishway to cost $3,200,000.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

AIR SOUNDINGS. Air Mass Soundings—IV. P. del Vecchio and D. Sayre. *Aviation*, vol. 34, no. 7, July 1935, pp. 16–18. Use of adiabatic chart; explanation of Rossby diagram; meteorograph soundings.

RAIN AND RAINFALL, IOWA. Analysis of Unusual Precipitation Records in Iowa. F. I. Mavis and J. W. Howe. *Am. Water Works Assn.—J.*, vol. 27, no. 2, Feb. 1935, pp. 174–190. Usual and unusual precipitation in Iowa recorded in climatological summaries of Weather Bureau; statewide annual means and extremes; analysis of unusual records; summary of data from duration curves.

INLAND WATERWAYS

CANAL LOCKS, FRANCE. Bemerkenswerte Einzelheiten am Rhein-Stauwehr fuer das Kraftwerk Kembs. *Schweizerische Bauzeitung*, vol. 105, no. 1, Jan. 5, 1935, pp. 1–5. Symposium by J. Beutefuehr and H. Blattner, containing descriptions of canal locks, fish ladder, and fish elevator of dam on Rhine River.

RIVERS, IMPROVEMENT. Conservancy of Rivers in Gangetic Delta with Special Reference to Tidal Rivers. A. N. Banerjee. *Assn. Engrs.—J.*, vol. 11, no. 1, Mar. 1935, pp. 1–11. Lack of artificial attempts to conserve rivers; conservancy of non-tidal rivers; principal changes in rivers of Gangetic Delta; conclusions from past history of main rivers; conserving rivers of central delta by Ganges barrage; comparison of tidal and non-tidal rivers; silt in tidal rivers; effect of reclamation on rivers.

LAND RECLAMATION AND DRAINAGE

EROSION, CHECK DAMS. Recommendations for Control and Reclamation of Gullies. O. C. Ayres. *La. State College Agriculture & Mechanic Arts—Eng. Experiment Station—Bulletin 121*, vol. 33, no. 41, Mar. 13, 1935, 71 pp., 3 supp. sheets. Treatment of small gullies; principles governing use of check dams; overfall protection; temporary check dams; semi-permanent or soil saving dams.

MATERIALS TESTING

BRICK CONSTRUCTION, REINFORCED. Load Tests on Structures of Reinforced Brick Masonry. *Can. Engr.*, vol. 67, no. 26, Dec. 25, 1934, pp. 3–6. Tests carried out at Mimico, Ont., showing that there is high factor of safety in present design of monolithic structures; details of three structures tested and results observed; "permanent set" of beams; slip of steel; failures; bond strength.

ROAD MATERIALS. Los Angeles Abrasion Machine for Determining Quality of Coarse Aggregate. D. O. Woolf and D. G. Runner. *Am. Soc. Testing Mats.—Advance Paper*, no. 77, June 24–28, 1935, 19 pp. Principal data considered in development of method of test for aggregate using abrasion machine, together with results of extensive series of tests in which service behavior of materials used in surface treatment work is compared with losses in Deval and Los Angeles abrasion tests.

PORTS AND MARITIME STRUCTURES

BEIRA, PORTUGAL. Development of Port of Beira. *Engineering*, vol. 139, no. 3623, June 21, 1935, pp. 663–664, 654 and supp. plates. Works consist of steel extension of timber lighterage wharf; widening, on which two transit sheds were built; deep-water wharf and approach, and power station; extension of deep-water wharf on screwed cylinder foundations and foundations for two transit sheds and embankment for retaining reclaimed land.

BOSTON. Port of Boston. F. S. Davis. *Naut. Gas.*, vol. 125, no. 16, Aug. 3, 1935, pp. 5–8. Port characteristics, development, and facilities discussed.

CALLAO, PERU. New Terminal at Callao, Peru. *Naut. Gas.*, vol. 125, no. 17, Aug. 17, 1935, pp. 5–7. Details of steamship terminal constructed by Frederick Snare Corp.; two breakwaters of riprap type with lengths of 7,200 and 3,300 ft, respectively; basin provided with channel 37 ft deep; docks consist of bulkhead wharf 1,920 ft long; auxiliary cargo-handling equipment; statistics giving general impression of movement of port.

CONCRETE. Service of Concrete Masonry and Reinforced Concrete Seaport Structures. A. T. Fyodorov. *Zentralniy Nauchno Issledovatelsky Institut Vodnogo Transporta—Sbornik Nauchno Issledovatelskikh Materialov*, 1934, pp. 23–73. Survey of condition of concrete marine structures in number of Russian ports, made of Novorossisk portland cement from 40 to 60 years ago; reinforced concrete piles cracked by mechanical stresses, deteriorated within from 3 to 17 years. (In Russian, with English abstract, p. 73.)

LE HAVRE. Port of Le Havre. M. Despujols. *Naut. Gas.*, vol. 125, no. 15, July 20, 1935, pp. 3–7 and 17. History of traffic with North America; port works added since World War; access to harbor; French Line maritime station; freight traffic.

MARINE BORERS. Pressure Treatment with Creosote. W. P. Arnold. *Mar. News*, vol. 22, no. 3, Aug. 1935, pp. 16–17, and 25. Comment on effective method of combating marine borers.

MONTREAL. Montreal Plans Port Development. E. L. Chicanot. *Mar. Rev.*, vol. 65, no. 8, Aug. 1935 pp. 16–18. Notes on harbor deepening and terminal expansion.

TIDES. Tides. N. Manolis. *Mar. News*, vol. 22, no. 3, Aug. 1935, pp. 24–25. Brief explanation of tidal phenomena and its significance in maritime ports.

ROADS AND STREETS

BRICK. Design of Brick Paving to Eliminate Skidding. G. F. Schlesinger. *Am. City*, vol. 50, no. 7, July 1935, pp. 55–56. Outline of recent practice; whitewash prevents sticking; use of calcium chloride and starch solution; comparisons; vertical fiber lug brick; filler research. Before Highway Research Board.

CONCRETE, ECONOMY. Economical Aspects of Cement Concrete Construction. F. I. Sheets. *Roads & Road Construction*, vol. 13, no. 148, Apr. 1935, pp. 117–119. Determination of traffic that road will be required to carry; determination of most economical concrete to use in construction; design of most efficient cross section to carry anticipated traffic loads with adequate structural life; determining annual road cost and annual cost of transportation.

CONCRETE, SUBSOILS. Some Theoretical Determinations in Design of Concrete Road Slabs. G. Berry. *Roads & Road Construction*, vol. 13, no. 145, Jan. 1, 1935, pp. 18–19. Safe values for varying types of subsoil; design of planes and reinforced slates.

CURVES. Aspects of Highway-Curve Design. H. Criswell. *Instn. Civ. Engrs.—Min. Proc.*, vol. 240, pt. 2, no. 4990, 1935, 34 pp., 1 supp. sheet. General discussion of curves and their angles of deviation; super-elevation or banking on curves; vertical curves and sight-lines; widening of carriageway on bends; examples from British practice.

FROST DAMAGE. Foundations and Protection Against Frost Heaving. A. Paradis. *Can. Engr.*, vol. 67, no. 16, Oct. 16, 1934, pp. 21–24. Experiments with sand cushion on Quebec roads to prevent damage from freezing conducted in various parts of province with success; cost of construction.

GEOPHYSICS. Subsurface Exploration by Earth Resistivity and Seismic Methods. E. R. Shepard. *Pub. Roads*, vol. 16, no. 4, June 1935, pp. 57–67 and 74. Experience of U. S. Bureau of Public Roads with earth resistivity and seismic methods of location of gravel deposits and other surfacing material, also as aid to classifying excavation in highway construction; principles involved in resistivity measurements; equipment and field tests; seismic apparatus; seismic method found preferable. Bibliography.

HIGHWAY ENGINEERING. Proceedings of Twenty-First Annual Highway Conference. *Univ. Mich.—Off. Publ.*, vol. 36, no. 63, May 8, 1935, 162 pp. Symposium including following: Retreads and Surface Treatments, O. S. Hess; Oil-Mix Surfaces, W. J. Slavin; Stabilized Surfaces in Oakland County, J. H. Barr; Low-Cost Roads in Upper Peninsula, G. D. Tramp; Some Economic Considerations Involved in Highway Improvement, T. R. Age; Elements of Cost of Various Types of Roads, W. S. Housel; State Highway Finances, G. D. Kennedy; County Road Commission Finances, A. M. Williams; Financing Municipal Streets with Motor Taxes, H. A. Olsen; Informing Public on Financial Problems, L. Webber; Speed and Safety: from State Highway Department Standpoint, M. D. Van Wagoner; from State Police Standpoint, L. A. Lyon; from City Police Standpoint, H. A. Pickert; Sheriff's Viewpoint on Traffic, J. Borden; Proposed Changes in State Motor Vehicle Law, R. Demaroff; Traffic Surveys under FERA, S. J. Williams; Looking Ahead at Traffic Problem, B. W. Marsh; Visual Safety Education, R. Sullivan; Self-Sufficiency, J. S. Worley; Transportation Engineering at University of Michigan.

HIGHWAY SYSTEMS, SOVIET UNION. Das Strassenwesen in Russland. K. Krueger. *Verkehrstechnik*, vol. 16, no. 12, June 20, 1935. (*Strassenbau u Strassenunterhaltung*) pp. 321–324. Descriptions and maps of highway systems of European Russia, Caucasia, Turkestan, and Siberia.

ITALY. Camionale Geno-Serra-Valle for Lorry Traffic. *Engineering*, vol. 139, no. 3624, June 28, 1935, pp. 669–672, supp. plate. Construction of new motor road from Genoa to Serravalle Scrivia, built to carry heavy motor-truck traffic; construction was executed under most unfavorable geological conditions; special measures adopted in construction of tunnels; details of more important viaducts.

MATERIALS, EMULSION. Zur Kenntnis des Kaltasphaltes (Asphaltemulsion) und dessen Verwendung im Strassenbau. W. Latzko. *Petroleum*, vol. 31, no. 11, Mar. 13, 1935, pp. 4–6. Cold asphalt emulsion for road construction; notes on methods of preparation and application.

MATERIALS, EMULSIONS, QUICK-SETTING. Emulsified Asphalts for Surface Treatments and Maintenance Methods. J. S. Miller, Jr. *Can. Engr.*, vol. 67, no. 26, Dec. 25, 1934, pp. 11–12. Emulsified asphalts found to develop full adhesiveness in comparatively short time; quick-setting property of emulsion; application of emulsified asphalts; resealing cracks in concrete pavements. Before Asphalt Paving Conference.

RAILROAD CROSSINGS, ELIMINATION. Erie Eliminates 15 Grade Crossings at Elmira, N.Y. *Ry. Age*, vol. 98, no. 26, June 29, 1935, pp. 1006–1011. Outline of project, which involves elevation of tracks through city for distance of 2½ miles, new bridge across the Chemung River, 1,565-ft viaduct, and 9 street bridges.

RAILROAD CROSSINGS, GRADE SEPARATION. Grade Separation—as Highway Engineer Sees It. H. E. Surman. *Ry. Age*, vol. 99, no. 6, Aug. 10, 1935, pp. 176–178. Discussion of some of more important considerations affecting selection and planning of projects. Before Western Soc. Engrs.

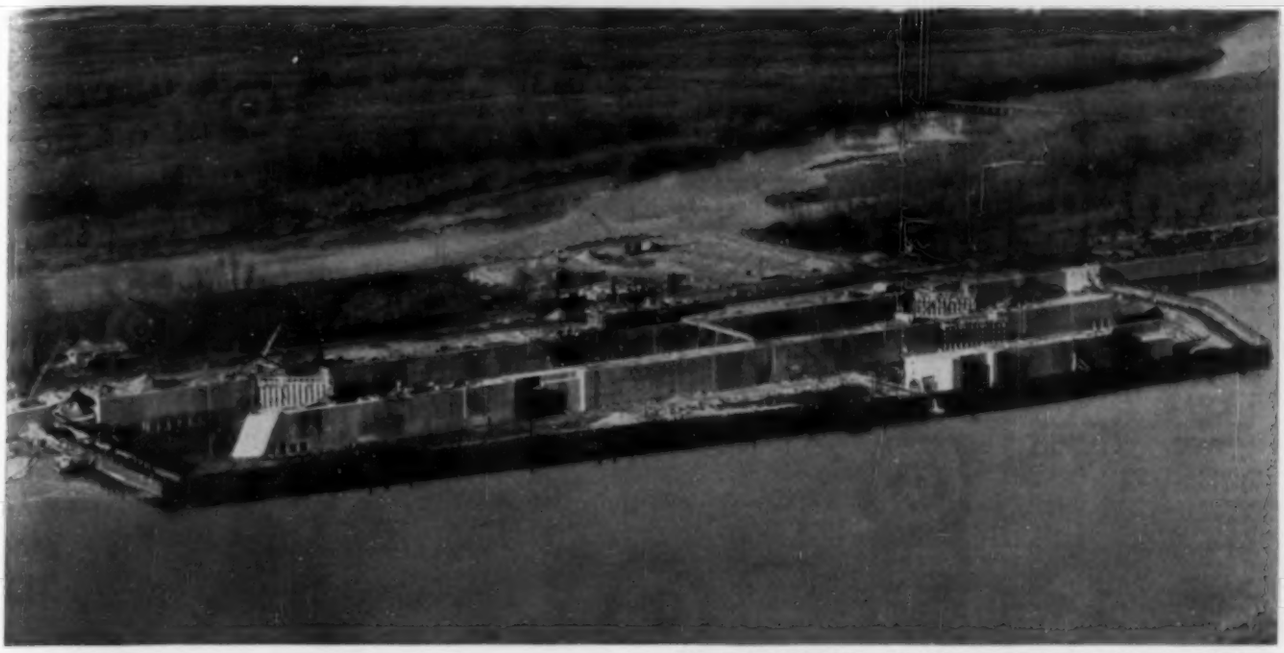
TRAFFIC SURVEYS. Extracts from Report on Florida Traffic Survey. L. E. Peabody. *Pub. Roads*, vol. 16, no. 4, June 1935, pp. 68–74. Results of survey made between Sept. 1933 and Sept. 1934 covering 157 points; characteristics of tourist traffic and transportation of citrus; average daily motor vehicle traffic on Florida highways, 1934; origin of motor tourist traffic to Florida and lines of travel.

SEWERAGE AND SEWAGE DISPOSAL

GASES, ANALYSIS. Determination of Traces of Hydrogen Sulfide in Sewer Gases. W. J. Wiley. *Indus. & Eng. Chem.—Analytical Edition*, vol. 7, no. 3, May 15, 1935, pp. 202–203. Description of field method, based on principle of absorption of hydrogen sulfide in potassium hydroxide and its colorimetric determination, using potassium plumbate and series of comparison tubes containing dye solutions prepared so as to correspond to various concentrations of gas.

ODOR CONTROL. Chlorinated Iron Solves Odor Nuisance and Improves Digester Performance. I. R. Riker. *Water Works & Sewerage*, vol. 82, no. 5, May 1935, pp. 172–174. Experience at Princeton, N.J., treatment works; greater practicability and superiority of ferrous or ferric iron salts in combination with partial pre-chlorination over and above pre-chlorination alone, especially when treating stale or septic sewages of high chlorine demand.

PARIS. Paris Sanitary Works. *Engineer*, vol. 159, no. 4142, May 31, 1935, p. 569. Brief note on sewer system and sewage disposal; also refuse collection and destruction.



Mississippi Lock No. 5A, Winona, Minn. 1500 tons of Inland Section I-31 used for permanent cut-off walls; 1200 tons Inland Section I-22 for temporary cofferdam. Project also involved 360 tons of Inland Reinforcing Bars.

Inland Piling Used Extensively on Upper Mississippi Waterway

THE 9-foot channel now being constructed by the Government on the upper Mississippi River is one of the greatest waterway developments ever undertaken. Already, Inland Steel Sheet Piling has been used for 10 units of this vast project.

This Piling is driven in temporary construction for building huge cofferdams. It is also employed as permanent cut-off walls below the great locks and dams that are dotting the river between St. Paul and St. Louis.

The experienced engineers and contractors who design and build these projects are able and discriminating judges of materials. Their selection of Inland Steel Sheet Piling should recommend its use to you. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Ill.

A COMPLETE LINE:

Inland produces all of the nine standard American Steel Sheet Piling Sections.

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A large stock of used Inland Piling in excellent condition is available for immediate shipment.

Sheets Strip Tin Plate
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INLAND STEEL

Rails Track Accessories
Bars Rivets Billets

PLANTS, GREAT BRITAIN. Sutton Manor Sewage Disposal Works, H. C. Rowley. *Instn. Mun & County Engrs.—J.*, vol. 61, no. 16, Jan. 29, 1935, pp. 839–847. Details of small plant, including egg-shaped outfall sewer, pumping station, two detritus tanks, one inverted pyramid settlement tank, two 60-ft rotary sprinkler filters, one inverted pyramid humus tank, four clinker sludge drying beds, and about 60 lin yd diversion of brook.

PUMPING PLANTS, CALIFORNIA. Underground Sewage Pumping Plant Serves San Pedro, California. *Am. City*, vol. 50, no. 7, July 1935, pp. 53–54. Description of Terminal Way sewage pumping plant of Los Angeles, Calif.; pump-pit structure is circular reinforced concrete unit with inside diameter of 34 ft and inside depth of 24 ft; portion of cylinder below motor-room floor is divided into wet and dry wells, by means of inner concentric cylinder with inside diameter of 13 ft; independent automatic duplicate units are located in dry well.

PUMPING PLANTS, HISTORY. Western Pumping Station, Pimlico, J. F. Petree. *Engineer*, vol. 159, no. 4146, June 28, 1935, p. 679. Opening of station took place on Aug. 5, 1875; plant comprised five pumping engines with 10 Cornish boilers; working pressure was 35 lb per sq in.; four principal double-acting condensing beam engines stood in pairs, back to back, in main engine house.

SEWERS, DESIGN. Design of Complete Sewerage System for Municipality, G. Phelps. *Can. Engr.*, vol. 67, no. 19, Nov. 6, 1934, pp. 19–26. Features which had to be considered in design of North Toronto system; combined vs. separate sewers; location of sewer outlet; computing runoff; estimating rate-of-flow; calculating size of sewer; repair of sewers; minimum size. Before Can. Inst. on Sewage & Sanitation.

SEWERS, OUTFALL. De nieuwe rioolmend in zee te Scheveningen, M. H. Ekker. *Ingenieur*, vol. 49e, no. 51, Dec. 21, 1934 (B. Bouwen Waterbouwkunde), pp. 221–227 (discussion) 227–233; see also French abstract *Génie Civil*, vol. 106, no. 5, Feb. 2, 1935, p. 117. Design and construction of new sewer outfall at Scheveningen, Netherlands; outfall, 475 m long, 2.20 m in diameter, is made of welded steel.

SLUDGE. Deammoniation of Sewage Sludges, A. L. Genter. *Indus. & Eng. Chem.*, vol. 27, no. 2, Feb. 1935, pp. 218–220. Use of chemical sludge-deammoniating agents such as formaldehyde together with deammoniation by elutriation; results show that such deammoniation treatment produces remarkable coagulant savings on both raw and digested sewage sludges; increased dewatering rates likewise result. Bibliography.

STRUCTURAL ENGINEERING

BEAMS, CONTINUOUS. Continuous Beams, J. Hanson. *Flight*, vol. 27, nos. 1374 and 1379, Apr. 25, 1935 (*Aircraft Engr.*), pp. 448f–448g, and May 30, (*Aircraft Engr.*), pp. 588d–588h. Graphical solution of most general problems.

PLATES, STRESSES. Knickung der rechteckigen Platte bei veraenderlicher Randbelastung, S. Ban. *Kyoto Imperial Univ.—College Eng. Memoirs*, vol. 8, no. 4, Mar. 1935, pp. 155–163. Theoretical mathematical discussion of buckling of rectangular plates with non-uniform loading along periphery; methods of differential equation and least work. (In German.)

SLABS, CONCRETE DESIGN. Tables for Slabs Designed to Ministry of Transport Load and Stress Requirements, E. A. Scott. *Structural Eng.*, vol. 12, no. 9, Sept. 1934, pp. 382–392. Tables of maximum moments of resistance and reinforcement for slabs from 6 in. to 30 in. thick, also tables of total free span, bending moments, minimum slab depths, and steel sizes, for spans from 3 to 30 ft, in accordance with requirements of British Ministry of Transport.

STEEL TRUSSES. Theorie des aussermittig gedrueckten Stabes aus Baustahl, E. Chwalla. *Stahlbau* (Supp. to *Bautechnik*), vol. 7, nos. 21, 22, and 23, Oct. 12, 1934, pp. 161–165, Oct. 26, pp. 173–176, and Nov. 9, pp. 180–184. Theory of eccentric compression of structural-steel trusses; relationship between moment and deflection of axis; determination of critical equilibrium conditions; comparative study of carrying capacity of truss eccentrically loaded; design tables.

STRUCTURAL DESIGN. Place of Sir Christopher Wren in History of Structural Engineering, S. B. Hamilton. *Newcomen Soc.—Trans.*, vol. 14, 1933–1934, pp. 27–38 (discussion), 39–42, supp. plates. His opinion on structural design, as gathered from comments and criticisms contained in reports submitted in his official capacity on condition of famous public buildings, including old and new St. Paul's; criticism of Salisbury Cathedral and Westminster Abbey; use of iron in St. Paul's Cathedral; views on equilibrium of arch; Gregory's catenaria and Wren's dome.

TUNNELS

VEHICULAR, VENTILATION. Midtown Hudson Tunnel. Fans, Motors, and Transmissions. *Port of N.Y. Authority—Contract MHT-8*, Sept. 1935, 126 pp. Specifications for furnishing and installation of 15 blower fans and 17 exhaust fans for ventilation system of first operating unit of Midtown Hudson Tunnel, New York City, together with motors and transmissions therefor; description of ventilation system, fans, motors, and transmissions.

WATER PIPE LINES

CONCRETE LINING. Old-Time Continuous Mixer Used for Concrete Tunnel Lining, F. Rasmussen. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, pp. 49–51. Equipment used in construction of lining of Chicago water supply tunnel ranging in diameter from 10 to 16 ft, including old-fashioned mixers and modern belt-conveyor distribution systems; details of steel forms.

CROSS CONNECTIONS. Report of Committee No. 8 on Cross Connections. *Am. Water Works Assn.—J.*, vol. 26, no. 12, Dec. 1934, pp. 1836–1842. Cross connections involved in outbreak of amoebic dysentery at Chicago, Ill.; regulations enacted; enforcement experience and activities. Bibliography.

WATER RESOURCES

CONTAMINATION. Effects of Road Oils and Tars on Public Water Supplies, L. V. Carpenter, R. W. Klinger, and G. R. Pyle. *Am. Water Works Assn.—J.*, vol. 27, no. 2, Feb. 1935, pp. 235–247. Experimental study of danger of contamination from washings from asphalt roads; manufacture and constituents of coal tars and their properties; water solubility of coal-tar compounds; specifications and analyses of tars used in tests; determination of phenolics by bromination; mixed cresols. Bibliography.

WATER TREATMENT

ANALYSIS. Angaben der Analysenwerte des Wassers, L. Suran. *Papier-Fabrikant*, vol. 33, no. 21, May 26, 1935, pp. 181–183. Values in water analysis; comparison of different values for expressing results of water analysis.

CHLORINATION. Equipment for Chlorination of Small Water Supplies, C. R. Cox. *Am. Water Works Assn.—J.*, vol. 26, no. 11, Nov. 1934, pp. 1587–1601. Methods of chlorination; control of automatic chlorinators; commercial chlorinators; brief descriptions of hypochlorite solution feeders manufactured by 11 companies and liquid chlorine feeders manufactured by 3 companies.

CHLORINATION, AMMONIA-CHLORINE. Chloramine Treatment in Duluth, D. L. Johnson. *Am. Water Works Assn.—J.*, vol. 27, no. 3, Mar. 1935, pp. 382–385. Operating data for period beginning Aug. 1931; disinfection of new mains; nature of reaction and cost.

COAGULATION. Coagulation with Iron Compounds, A. P. Black. *Am. Water Works Assn.—J.*, vol. 26, no. 11, Nov. 1934, pp. 1713–1718. Fundamental theory involved in process of coagulation with iron compounds and with alum; results obtained with ferric coagulants in treatment of various types of water; advantages from use of ferric coagulants; importance of hydrogen-ion concentration; results obtained in Elizabeth City, N.C., Dallas, Tex., Providence, R.I., and Pacific Coast area. Bibliography.

COAGULATION, CONTROL. Coagulation Control with Recording Potentiometer, E. S. Hopkins. *Am. Water Works Assn.—J.*, vol. 27, no. 1, Jan. 1935, pp. 94–99. Characteristics of newer electrodes; description of apparatus; operating data; care of equipment. Bibliography.

FILTRATION, MATERIALS. Report of Filtering Materials Committee. *Am. Water Works Assn.—J.*, vol. 26, no. 11, Nov. 1934, pp. 1701–1712. Data on floc penetration and filter condition; experiments on penetration; sand bed hydraulics.

FILTRATION, SAND. Filter Sand Experiments, L. F. Allan. *Am. Water Works Assn.—J.*, vol. 27, no. 2, Feb. 1935, pp. 205–219. 1932 experiments at Island Filtration Plant in Toronto to obtain data concerning filtering properties of various grades of sand; filter beds of graded sand; operating conditions, etc.; description of apparatus; filtration; filter washing; sand rise; temperature and viscosity; filter beds of uniform grade of sand; separation into grades; penetration of sediment and critical depths of filter media; depth of sediment penetration in uniform grades of sand.

PLANTS, SPRINGFIELD, ILL. New Water Purification Plant for Springfield, Illinois, C. H. Spaulding and C. S. Timanus. *Am. Water Works Assn.—J.*, vol. 27, no. 3, Mar. 1935, pp. 327–336. Description of 36-mgd water treatment plant now in course of construction; comparison of old and new processes of coagulation and sedimentation; pretreatment; recarbonation; filters; chemicals.

SOFTENING, CALIFORNIA. Economic Feasibility of Municipal Water Softening in California, P. J. Beard and G. C. White. *Am. Water Works Assn.—J.*, vol. 27, no. 2, Feb. 1935, pp. 248–263. Results of survey; data on possible savings from water softening in cities; return on investment. Bibliography.

TASTE AND ODOR REMOVAL. Trend of Modern Taste and Odor Control, F. E. Stuart. *Am. Water Works Assn.—J.*, vol. 27, no. 4, Apr. 1935, pp. 503–508. Comparative study of control by prechlorination, ammonia-chlorine, powdered activated carbon, and activated carbon in wash water.

WATER BACTERIOLOGY. Occurrence and Control of Iron Bacteria in Water Supplies, K. W. Brown. *Am. Water Works Assn.—J.*, vol. 26, no. 11, Nov. 1934, pp. 1684–1698, (discussion) 1698–1700. Results of author's experiences in California and of study of these organisms in laboratory as well as in field, attention being directed especially to factors of practical importance involved in their identification, their characteristic effects on quality, and methods of treatment required for their control.

WATER WORKS ENGINEERING

FINANCING. Financial History of Water Department of City of New York, J. Goodman. *Am. Water Works Assn.—J.*, vol. 26, no. 12, Dec. 1934, pp. 1787–1792. Review covering period beginning with 1842.

INTAKES. Anchor or Frazil Ice at Buffalo Intake, A. D. Drake. *Am. Water Works Assn.—J.*, vol. 27, no. 1, Jan. 1935, pp. 78–82. Description of Niagara River intakes of water works of Buffalo, N.Y.; observations on formation of ice and methods of ice control at intakes.

LOS ANGELES. Owens Valley Aqueduct Extension Includes 11.3-Mile Tunnel. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, pp. 47–49. Los Angeles plans two regulation dams, also small dams and conduits to intercept and collect flow of several streams entering Mono Lake; construction to extend over 3½-year period.

MAINTENANCE AND REPAIR. Problems of Water Works Superintendents. *Am. Water Works Assn.—J.*, vol. 27, no. 3, Mar. 1935, pp. 313–326. Symposium including following: Some Equipment Used in Maintenance, G. G. Routledge; Testing Domestic Water Meters for Low Rate of Flow and Its Effect on Revenue, T. Hodkinson; Automatic Control of Deep Wells and Electricity in Thawing Frozen Water Pipes, A. G. Peirson; Problems of Filtration Plant Operation, G. H. Baker.

MAINTENANCE AND REPAIR, EMERGENCIES. Modern Devices for Improving Water Works Service, L. A. Smith. *Am. Water Works Assn.—J.*, vol. 27, no. 2, Feb. 1935, pp. 264–267. Emergency service; gate valves in manholes; aquaphone; electric leak locator; dip needle; book showing to scale location of all mains, hydrants, valves, and services.

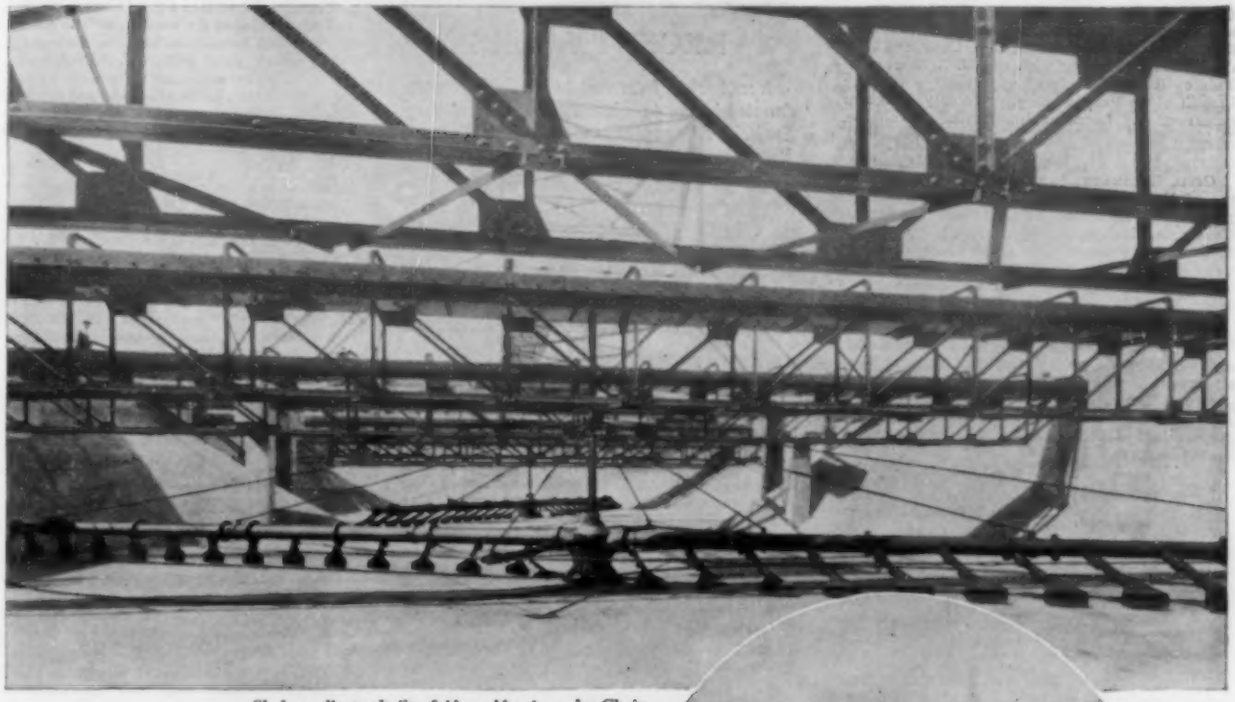
MANAGEMENT. Engineering Business Practice Relating to Detroit Additional Water Supply Project, E. W. Frey. *Am. Water Works Assn.—J.*, vol. 27, no. 3, Mar. 1935, pp. 295–312. Abstract of author's "Treatise on Engineering Practice Relating to Detroit Additional Water Supply Project"; organization and personnel; office administration; method of handling tracings and blue prints; filing correspondence; specifications and contracts; arbitration; construction inspection; consultants service; accidents; preliminary tests and experiments; accounting.

UNITED STATES. Public Works and Water Supply Construction, A. Wolman. *Am. Water Works Assn.—J.*, vol. 26, no. 10, Oct. 1934, pp. 1363–1373. Critical review of three major aspects of public-works program; what is amount of public work necessary during given time, when is logical time in which to carry out extensive undertakings, and how is best way to do it—through federal, local, or combined auspices; author's conclusions presented.

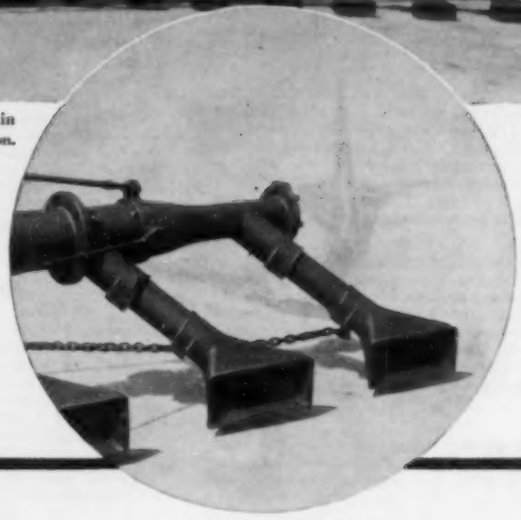
WASTE ELIMINATION. Effective Publicity as Means of Eliminating Water Waste, H. L. Meites. *Am. Water Works Assn.—J.*, vol. 26, no. 12, Dec. 1934, pp. 1811–1820. Illustrated review of publicity methods used by water department of Chicago, Ill.

WASTE SURVEYS. Water Waste Surveys and Distribution Systems Studies, D. D. Gross. *Am. Water Works Assn.—J.*, vol. 27, no. 4, Apr. 1935, pp. 485–493. Review of modern practice with special reference to experience of water works of Denver, Colo.

WATER WELLS, DRILLING. Einige Erfahrungen mit dem Seilschlagbohrkran-System, A. Wirth, A. Abrossinoff. *Bohrtechniker-Ztg.*, vol. 53, no. 2, Feb. 15, 1935, pp. 46–49. Some experiences with A. Wirth system of derrick model No. 15, when drilling for water in Southern Ukrania, USSR; geological conditions of district; drilling operations and results.



Sludge collector built of Alcoa Aluminum by Chain Belt Company for Milwaukee Sewage Commission.



★ By saving weight Alcoa Aluminum improves the operation

This sludge collector is a striking example of important operating advantages which may be achieved by the inherent lightness of Alcoa Aluminum.

Superior ability to withstand corrosion is the prime reason for the rapidly increasing use of alloys of Alcoa Aluminum in Sewage plants.

Starting from that premise, the designers of this collector found that the *light weight* plus the *strength* of Alcoa Aluminum made possible a more nearly self-supporting construction.

Elimination of supporting trusses of course decreases the total turbulence caused by the rotating collector. Thus the settling process is benefited by a fundamental characteristic of Alcoa Aluminum.

This Milwaukee plant also uses large quantities of Alcoa Aluminum for other plant equipment, for a large variety of architectural details, and as pigment for protective painting.

May we be of service in helping you use this corrosion-resistant metal most economically? ALUMINUM COMPANY OF AMERICA, 1827 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

Colorado; graduate work in hydraulics and structures; 6 months experience as instructor; 6 months as instrumentman, U. S. Coast and Geodetic Survey; 1 year with the U. S. Bureau of Public Roads. Desires opportunity in any branch of civil engineering, preferably design or construction. Location immaterial. Available. D-4282.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; graduate of Yale University; 28; single; 4 years experience in all phases of gold-lode mining in California, including construction; competent to make mine examinations and operate properties; desires a connection with soundly financed young mining organization or with construction firm. C-5760.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; married; age 31. Experience: 2 years highway, 1 year structural, 1 year mining, and 1 year civil engineering. Education: B.S. in civil engineering and graduate study in structural and sanitary engineering. Good references. Location United States or foreign. C-3877.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., Carnegie Institute of Technology, 1932. About 2 years of surveying experience, with 1 year as transitman on sewers, streets, and general topography. Desires opportunity in any branch of civil engineering. Willing to work. Location immaterial, but Pittsburgh district preferred. Available immediately. D-4195.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; New Jersey license; M. Sc. in C.E., Rutgers University, 1935; 8 years experience in construction. Can handle men. Chief interests—structures, highways, surveying, or sanitation. Will also consider teaching. Prefers New York or vicinity, but will go anywhere. Initial salary secondary if connection is permanent. D-4146.

RECENT GRADUATE; Jun. Am. Soc. C.E.; M. C.E.; 24; single; 2 years as graduate scholar in civil engineering department. Engineering economics and structural engineering, principal fields of interest. Position as instructor or graduate assistant desired. Experience teaching resistance of materials and as assistant in civil engineering laboratory and surveying courses. D-2990.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; married; B.S. in C.E., California Institute of Technology, 1933; 2 months in geodetic surveying, University of Michigan (Camp Davis); 9 months as scientific aide, U. S. Department of Agriculture; 1 year exploitation engineering-field trainer; 1 year junior exploitation in production research problems. Speaks German, French, and Dutch fluently. Desires opportunity in any branch of engineering. Available. D-4287.

SALES

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; 15 years sales-engineering experience; acquainted with public works officials and contractors throughout East; will consider representing manufacturers of meritorious public works products; has own office. B-5401.

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; 10 years in the United States; graduate in business management. Now resident abroad with finest connections. Receptive to negotiations for association with American concern wishing representation in the Scandinavian countries. Investigations, reports, translations, advertising, research. C-5983.

TEACHING

CIVIL ENGINEER; M. Am. Soc. C.E.; S.P.E.E.; Methodist Church; Masonic Lodge; degrees B.S. in C.E.; C.E.; M.S. Major in structural engineering, minor in highway engineering; age 44; 6 years varied practical experience; 13 years successful teaching experience; 9 years as village engineer. Desires position teaching civil engineering or applied mechanics. D-302.

RECENT BOOKS

New books of interest to Civil Engineers, donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves and this Society is not responsible for them.

BEIHEFTE ZUM GESUNDHEITS-INGENIEUR, REIHE 1, HEFT 35. WÄRMEBEDARFSBESTIMMUNG VON KIRCHEN. By H. Gröber and W. Sieler. Munich and Berlin, R. Oldenbourg, 1935. 7 pp., charts, 12 × 9 in., paper, 2.50 rm.

This paper presents a method for determining the size of heating plants for churches and similar structures which are used for only a few hours at infrequent intervals. The author presents charts that facilitate the calculations.

DESIGN OF CONCRETE STRUCTURES, 3 ed. By Leonard C. Urquhart and Charles E. O'-Rourke. New York and London, the McGraw-Hill Book Company, Inc., 1935. 556 pp., illus., tables, charts, diagrs., 9¼ × 6¼ in., cloth, $4.50.

This book provides a text on concrete and reinforced concrete for both elementary and more advanced engineering courses. In this revision most of the material has been rewritten to include the latest and best practice in plain and reinforced concrete design. In the development of the elementary design theory, the principle of the transformed section has been used in addition to the usual design formulas. Additional material has been added, and tables and diagrams have been expanded for use with the higher strength concretes of the present day.

Eidgenössische Materialprüfungsanstalt an der E.T.H. in Zürich (Laboratoire Fédéral d'-Essai des Matériaux annexé à l'École Polytechnique Fédérale à Zürich) Bericht Nr. 93. ZUR WASSERREINIGUNG MIT TRINATRIUMPHOSPHAT, by P. Schläpfer. Zürich, July 1935. 9 pp., charts, tables, 12 × 8 in., paper, apply.

The problems investigated in this study were the comparative values of soda and various commercial brands of trisodium phosphate as water softeners, the degree of softness attainable with the latter, and the detection of phosphoric acid in boiler water.

FENSTER, TÜREN, TORE AUS HOLZ UND EISEN, (Sammlung Göschen, 1092). By W. Wickop. Berlin and Leipzig, Walter de Gruyter & Co., 1935. 149 pp., diagrs., charts, tables, 6 × 4 in., cloth, 1.62 rm.

A brief, practical text upon the design and construction of windows, doors, and gates, intended for students of architecture and building.

FINANCIAL INCENTIVES, a Study of Methods for Stimulating Achievement in Industry. (National Industrial Conference Board Studies, Number 217). New York, National Industrial Conference Board, 1935. 47 pp., tables, 9 × 6 in., paper, $1.50.

Conditions during the past five years have subjected wage-incentive plans to a severe test. This study by the National Industrial Conference Board reviews the experience of industrial concerns in operating such plans under the new conditions, describes the changes that have been necessary, and discusses the probable future rôle of incentives.

Great Britain, Department of Scientific and Industrial Research. REPORT OF THE CHEMISTRY RESEARCH BOARD for the period ended December 31, 1934, with Historical Introduction and Report by the Director of Chemical Research. London, His Majesty's Stationery Office, 1935. 94 pp., diagrs., tables, 10 × 6 in., paper, 1s. 6d. (Obtainable from British Library of Information, 50 cents.)

The report contains a brief history of the board, and summaries of its work upon the corrosion of metals, high pressures, tar, chemotherapy, synthetic resins, water pollution, microbiology, road tar, dental materials, and chemical engineering. Complete lists of the scientific publications and patents issued since 1926 are appended with historical introduction and report by the director of chemical research.

LIGHTHOUSES OF THE MAINE COAST AND THE MEN WHO KEEP THEM. By R. T. Sterling; introduction by R. P. T. Coffin. Brattleboro, Vermont, Stephen Daye Press, 1935. 223 pp., illus., 9 × 6 in., cloth, $3.

In this book the assistant keeper of the Portland Head light tells of the romance and routine of lighthouse life and gives the history of the lighthouses and their keepers. Photographs of most of the Maine lights are given.

MATERIALS TESTING MACHINES. By C. H. Gibbons. Pittsburgh, Instruments Publishing Co., 1935. 89 pp., illus., tables, 8 × 5 in., cloth, $2.

This account of the development of testing machines traces their history from the experiments of Galileo to the present day. The author is especially interested in the tension-compression-transverse group of machines, and traces their history carefully. Many interesting illustrations of important machines are included.

OLD COVERED BRIDGES. By A. M. Jakeman. Brattleboro, Vermont, Stephen Daye Press, 1935. 107 pp., illus., 10 × 7 in., cloth, $2.50.

After a brief outline of the history and construction of covered bridges, the major part of this book is devoted to the existing covered bridges in Massachusetts and Connecticut. Excellent photographs of twenty-six bridges are given, with brief descriptions of each.

Schweiz. Verband für die Materialprüfungen der Technik. (Association Suisse pour L'Essai des Matériaux.) Bericht Nr. 29 (Bericht Nr. 83 der Eidg. Materialprüfungsanstalt). BEITRÄGE ZUR KENNTNIS DER SPANNUNGSVERTEILUNG IN PRISMATISCHEN UND KEILFÖRMIGEN KONSTRUKTIONSELEMENTEN MIT QUERSCHNITTÜBERGÄNGEN. By R. V. Baud. Zürich, November 1934. 72 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, apply.

Describes experimental investigations of the stress distribution in beams with varying cross sections, the pole fastenings of dynamos and motors, in gear teeth and in screws. Photoelastic methods were used, and data of practical value to the machine builder and civil engineer have been obtained.

TRAVAUX MARITIMES. Vol. 2. (Bibliotheque de l'Ingénieur de Travaux Publics.) By L. Prudon. Paris, Dunod, 1935. 490 pp., illus., diagrs., charts, tables, 7 × 5 in., cloth, 87 frs.; unbound, 78 frs.

A practical treatise on the construction of dikes, breakwaters, jetties, and other maritime works. The general processes of construction, by means of cofferdams, compressed air, excavating machinery, floating caissons, sheetpiling, etc., are described. About one-half the text is devoted to the design and construction of seawalls and jetties. The text is illustrated throughout by examples of actual practice. It will be interesting to builders of maritime works generally, for it brings together much information not readily available.

THE WORK OF THE SANITARY ENGINEER, a Handbook for Engineers, Students, and Others Concerned with Public Health. By Arthur J. Martin. London, Macdonald and Evans (8 John Street, Bedford Row, W. C. 1), 1935. 488 pp., 81 illus., tables, 8½ × 5½ in., cloth, 16s.

This book is intended to give engineering students a surer grasp of the principles upon which sanitary engineering is based. Although it is primarily concerned with the broader aspects of the engineer's work, its practical side has not been overlooked. There are brief outlines of hydraulics, chemistry, bacteriology, and geology. A number of original tables and formulas are now published for the first time, and a section of the book is devoted to the subjects of public health, law and sanitary administration.

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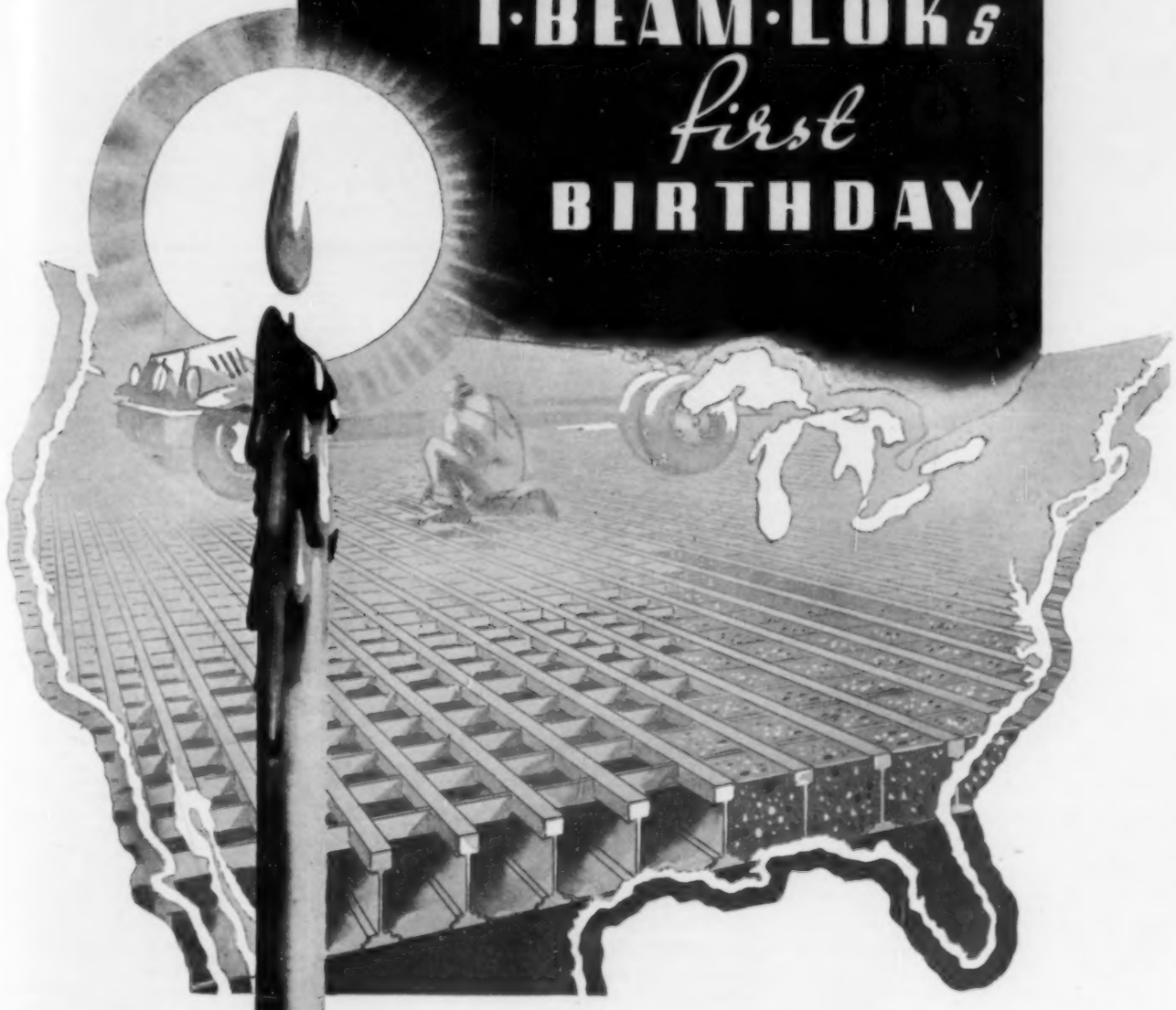

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BRIDGES

BASCULE, BOSTON, MASS. New Bridges Remove Bottlenecks on Boston Shore Highways. *Eng. News-Rec.*, vol. 115, no. 3, July 18, 1935, pp. 71–75. Bascule spans, 126 ft and 219 ft long, characterize expensive state highway structures over Saugus and Fore rivers, respectively north and south of Boston; cantilever plate-girder spans, operating equipment for bascules and anchored pier.

CONCRETE ARCH, RICHMOND, VA. Steel Falsework Supports Forms for Multiple-Arch Bridge. *Construction Methods*, vol. 16, no. 10, Oct. 1934, pp. 26–29. System of portable structural steel bents, erected on arch ribs, supporting forms for slender spandrel columns and deck on 3,300-ft bridge across James River, in Richmond, Va.

HIGHWAY, NEW YORK. New York's Triborough Bridge. *Eng. News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, pp. 177–183. Description of bridge development joining three boroughs of New York City across Hell Gate and adjacent waters, including 3 1/5 miles of bridge structure and 14 miles of connecting roads; suspension span of 1,380 ft carried by two cables 98 ft apart; structural details.

RIGID FRAME. Rigid Frame Concrete Bridges and Their Application to Grade Eliminating Projects, R. R. Zipprodt. *Boston Soc. Civ. Engrs.—J.*, vol. 21, no. 4, Oct. 1934, pp. 336–347. Theory and practice of short-span, rigid-frame concrete bridge construction with special reference to American experience.

STEEL TRUSS. Hamilton Unit System of Bridge Construction. *Engineering*, vol. 140, no. 3630, Aug. 9, 1935, pp. 131–133, supp. plates. System, designed primarily for military bridge, but suitable for numerous applications for temporary use and permanent installation in undeveloped or mountainous countries; special form of Warren truss employed; diagonals entirely composed of 6 by 6 by 1/2-in. angles, 10 ft in length; angles can be used single, double, treble, or quadruple in all members of truss; results of tests.

STEEL TRUSS, BELGIUM. Vierendeel Truss Bridges Popular in Belgium, L. G. Rucquoi. *Eng. News-Rec.*, vol. 115, no. 4, July 25, 1935, pp. 116–118. Review of recent Belgian practice in construction of railroad highway bridges employing rigid panel trusses without diagonals; use of reinforced concrete Vierendeel frames. Bibliography.

VIADUCTS, CONCRETE. Viaduct Piers Built with Plywood Forms and Vibrated Concrete. *Construction Methods*, vol. 16, no. 6, June 1934, pp. 32–34. Construction of 33 concrete piers for viaduct section of Route 21, at Newark, N.J., using system of form clamps and ties which facilitated rapid stripping and re-use of plywood panels and method of internal concrete vibration, employing air-driven vibrator.

VIADUCTS, MOVING. Horse-Powered Capstans Move 1,200-Ton Calvert Street Bridge. *Construction Methods*, vol. 16, no. 8, Aug. 1934, pp. 26–29. Method of moving old steel-trestle bridge over Rock Creek ravine, in Washington, D.C., 125 ft high, to new foundations, 80 ft south, with aid of five capstans, each powered by one horse, and two one-man winches.

VIADUCTS, RAILROAD. Place Concrete in Sub-Zero Weather in Erie Railroad Viaduct. *Concrete*, vol. 43, no. 2, Feb. 1935, pp. 11–12. Principal features of construction of viaduct of reinforced concrete construction of flat-slab type; 1,700 ft long; carrying two main-line tracks of Erie Railroad and third track for part of its length, in grade separation program; use of metal and plywood forms; placing and curing concrete; concreting during sub-zero weather; curing with live steam; waterproofing structure.

VIADUCTS, STEEL. Constructs High Steel Viaduct with Company Forces. *Ry. Age*, vol. 99, no. 8, Aug. 24, 1935, pp. 237–239. Viaduct across Big Clifty creek on Illinois Central's Louisville division replaces old structure; work included construction of masonry substructure, erection of superstructure, dismantling of old viaduct, and placing of 31,500 cu yd of filling material in approach embankments.

BUILDINGS

EARTHQUAKE EFFECT. Some New Problems of Free Vibrations of Structure, K. Sezawa and K. Kanai. *Tokyo Imperial Univ.—Earthquake Research Inst.—Bul.*, vol. 12, pt. 4, Dec. 1934, pp. 804–822 and 823–853. Theoretical mathematical analysis of periods of natural vibrations of framed structures having different conditions as regards connection of columns with floors and bases; criteria for stiffness of building resisting against horizontal vibrations; forced vibration problem particularly of case where movements of ground are horizontally polarized and of simple harmonic type; modes of oscillations of structure due to movements of ground of given amplitudes and periods; distribution of bending moments in columns due to movement of ground of given acceleration. (In English.)

FIRE PREVENTION. Feuerschutz durch besondere Baustoffe und Bauteile, H. Amos. *Bautenschutz*, vol. 5, no. 7, July 5, 1934, pp. 73–82. Details of special designs of structural elements for fire resistance, including encasement of steel girders in hollow brick, pumice concrete, etc.

FOUNDATIONS. Building Wall Underpinned Without Resort to Shoring, L. M. Zach. *Eng. News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, pp. 189–190. Description of novel method of underpinning 13 upper stories in northerly half of Pulitzer Building, Park Row, New York, using steel needle beams and no shoring, employed in alteration which substituted steel column and second-floor girders for heavy masonry walls.

PLANETARIUMS, NEW YORK. Thin Concrete Shell Dome for New York Planetarium, P. F. Pape. *Eng. News-Rec.*, vol. 115, no. 4, July 25, 1935, pp. 105–109. Design and construction of concrete shell of Hayden Planetarium having diameter of 80 ft and thickness of only 3 in.; octagonal arrangement of steel columns and steel cantilever beams supporting concrete shell; variation of stresses from crown to spring line. See also appendix by R. L. Bertin, pp. 108–109.

CONCRETE

AGGREGATES, MOISTURE CONTENT. Moisture in Concrete Sand Measured by Electric Current, C. E. Wuerpel. *Eng. News-Rec.*, vol. 115, no. 2, July 11, 1935, pp. 52–54. Description of apparatus experimented with in construction of locks and dam on Mississippi River at Alton, Ill., having electrical circuit utilizing plate in sand bin for one electrode and steel bin wall for other; conductance of materials; moisture-control curves calibrated for Missouri River sand; errors of determination are within three-tenths of 1 per cent.

ARCHITECTURAL ASPECTS. Concrete. Form—Texture—Color, A. M. Stires. *Am. Architect*, vol. 147, no. 2636, Aug. 1935, pp. 70–82. Architectural and general esthetic aspects of concrete as structural material; color; stains and oil paints; craftsmanship in concrete; cast stone and concrete masonry.

BOULDER DAM PROJECT. Boulder Dam, G. R. Robertson. *Indus. & Eng. Chem.*, vol. 27, no. 3, Mar. 1935, pp. 242–249. Treatment of cement and concrete to overcome production of chemical heat of hydration by reduction of aluminate and increase of silicate in cement; cooling system; concrete mixing; contraction cracks; safety factor. Bibliography.

CEMENT ADMIXTURES, CALCIUM CHLORIDE. Calcium Chloride Improves Cement and Concrete, P. Rapp. *Concrete*, vol. 43, no. 6, June 1935, pp. 11–12. Report of Bureau of Standards shows favorable influence of material; decreases and increases workability and strength of concrete. Before Highway Research Board.

CEMENT SETTING. Setting of Portland Cement, W. C. L. Hemeon. *Indus. & Eng. Chem.*, vol. 27, no. 6, June 1935, pp. 694–699. Experimental study of setting of portland cement paste by means of rates of contraction of two phases, cement and water showing that there are marked differences in rates of contraction of cement pastes of approximately same potential compound composition; rates of heat evolution of cement pastes; reproducibility of results; effect of fineness; classification of rate curves. Bibliography.

CONSTRUCTION. Great Volume of Concrete Work in Conservation Program, A. F. Unckrich. *Concrete*, vol. 43, nos. 2 and 3, Feb. 1935, pp. 13–14, and Mar., pp. 9–10. Program involves construction of concrete and earthfill dams, check dams, spillways, revetments; relocation of highways, bridges and buildings, water works and sewage disposal plants; how conservancy districts operate.

CONSTRUCTION, VIBRATING, FRANCE. L'emploi du béton vibré pour la réparation des ouvrages en béton armé, C. Tournay. *Revue Universelle des Mines*, vol. 78, no. 9, July 1935, pp. 326–334. Use of vibrated concrete for repair of reinforced concrete structures; conclusions based on results of various applications.

CONSTRUCTION, VIBRATING, SAN FRANCISCO. Placing Concrete by Means of Vibration. *Am. Concrete Inst.—J.*, vol. 6, no. 5, May–June 1935, pp. 527–556. Symposium including following papers: Freezing and Thawing, Permeability and Strength Tests on Vibrated Concrete Cylinders of Low Cement Content, M. O. Withey; Vibration of Concrete on San Francisco–Oakland Bay Bridge, T. E. Stanton, Jr.; Vibration as Aid in Placing Better Concrete, L. H. Tuthill; High Frequency Vibration as Applied to Construction of Concrete Pavements, F. H. Jackson.

CURING. Cheap Curing with Cotton Mats on Texas Pavements, J. G. Rollins. *Eng. News-Rec.*, vol. 115, no. 3, July 18, 1935, p. 76. Experience of Texas State Highway Dept; seven trial mats used during 1934 and since have been relaid 57 times and appear good for use 25 times more.

DESIGN. Reinforced Concrete Design, H. F. Wilmot. *Civ. Eng. (London)*, vol. 29, no. 339, Sept. 1934, pp. 310–311, 1 supp. sheet. Graphic representation with curves for calculation of slabs, beams, and I-beams where neutral axis is below slab by not more than one-quarter of thickness.

DISINTEGRATION. La corrosion des bétons armés, E. Marcotte. *Chimie & Industrie*, vol. 33, no. 5, May 1935, pp. 1053–1060. Corrosion of reinforced concrete, particularly in marine structures; study of effect of water on concrete structures and means of corrosion prevention.

DISINTEGRATION, CHIMNEYS. Zerstoerungserscheinungen an Industrie-Schornsteinen, M. Stiller. *Bautenschutz*, vol. 5, no. 9, Sept. 5, 1934, pp. 97–100. Observations on disintegration of concrete and masonry chimney materials caused by smoke and gases; methods of prevention.

HOUSES. Reinforced Concrete House Building Offers Attractive Market, E. W. Dienhart. *Concrete*, vol. 43, no. 7, July 1935, pp. 6–8. Type claimed to resist violent storms and rains, fires, earthquakes, hot and cold weather, ground water, and termites; types of walls; forms; reinforcement; partitions; floors; utility provisions; mixing and placing concrete; exterior and interior finishes; insulation.

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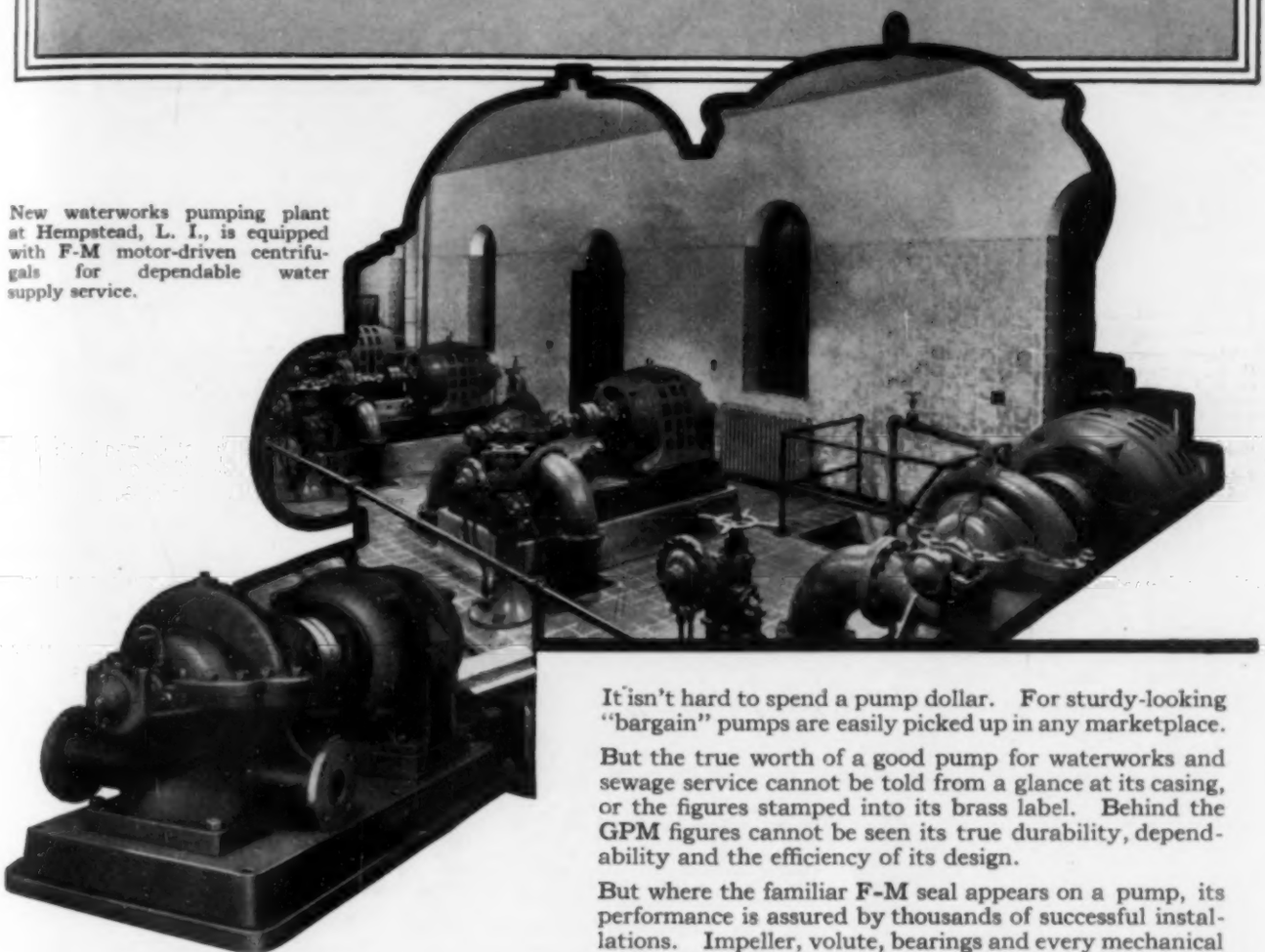

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MASONRY MATERIALS, PROTECTIVE COATINGS. Schutzanstriche fuer Beton und Mauerwerk, C. R. Platzmann. *Tonindustrie-Ztg.*, vol. 59, no. 18, Feb. 28, 1935, pp. 228–231. Protective coatings for concrete and masonry; colorless and transparent exterior coatings; black paints for concrete, masonry, and iron.

MIXING, PROPORTIONS. Effects of Composition on Strength of Concretes, L. N. Jamieson. *Instn. Engrs. Australia—J.*, vol. 7, no. 5, May 1935, pp. 168–173. Reasons for strength variations in concrete; cement as adhesive; relation between strength and cement concentration; mechanical effects of quality and proportions of aggregates on strength; structural effects of shape and proportions of aggregates on strength, and chemical effect of cement-water ratio on strength. Bibliography.

MIXING, RAPID METHOD. Le dosage des bétons, R. Dantinne and R. Jacquemin. *Revue Universelle des Mines*, vol. 78, no. 9, July 1935, pp. 301–309. Proportioning of concrete with view to most economical and rational utilization of binder; example of practical and rapid method based on use of Fuller-Bolomey curve in connection with Abrams modulus of fineness; second example given shows weakness of proportioning according to granulometric curves or moduli of fineness.

READY-MIXED EQUIPMENT. Facts About Ready-Mixed Concrete. *Concrete*, vol. 43, no. 4, Apr. 1935, pp. 9–10. National Ready-Mixed Concrete Assn. conducts survey of type of operation, kind of equipment, size of plant and capital investments; list of literature available on subject.

REINFORCEMENT, WELDED WIRE. Show Value of Welded Wire Fabric as Slab Reinforcement, T. D. Mylrea. *Concrete*, vol. 43, no. 7, July 1935, pp. 10–11. Review of tests at University of Delaware.

WATERPROOFING. Moerteldichtungsmittel, C. R. Platzmann. *Tonindustrie-Ztg.*, vol. 59, no. 5, Jan. 14, 1935, pp. 53–54. Waterproofing materials for mortars; results of author's experiences with mortar admixtures, chemical waterproofing materials and protective coatings and their properties, testing and preparation.

DAMS

BOULDER DAM PROJECT, CONSTRUCTION. Boulder Dam and Los Angeles Region. *Eng. News-Rec.*, vol. 115, no. 4, July 25, 1935, pp. 125–127. Progress reports on construction at Boulder Dam and Los Angeles River aqueduct.

CONCRETE, CONSTRUCTION. Demountable Cableways Place Concrete at Norris Dam. *Construction Methods*, vol. 16, no. 11, Nov. 1934, pp. 46–49. Method of handling of 1,000,000 yd of concrete required in construction of Norris dam, Tennessee, with duplicate 1,925-ft span cableways, each having rated capacity of hoisting 18 tons on hook at 300-ft, lowering this load at 400 ft, and conveying it at 1,200 ft per min.

CONCRETE GRAVITY, AUSTRALIA. Design and Construction of Wellington Dam, E. Tindale. *Commonwealth Engr.*, vol. 22, no. 1, Aug. 1, 1934, pp. 5–8. Design and construction of curved, concrete-gravity, overflow dam—maximum height 68 ft, length 748 ft—for Collie River irrigation project, Western Australia.

CONCRETE GRAVITY, WASHINGTON. Progress at Grand Coulee. *Eng. News-Rec.*, vol. 115, no. 5, Aug. 1, 1935, pp. 139–160. Symposium on design and construction of Grand Coulee Dam, having proposed ultimate height of 540 ft; 1,650 ft long; Grand Coulee Project and Dam, K. B. Keener; Ten Months' Construction Progress; Constructing First Cofferdam; I—Planning for Excavation Disposal, F. Donaldson; II—Belt Conveyors in Operation; III—Designing Belt System, S. M. Mercier; Making Aggregate at Grand Coulee.

CONSTRUCTION, MATERIALS HANDLING. Material-Handling Plant for Norris Dam. *Construction Methods*, vol. 16, no. 9, Sept. 1934, pp. 42–45. Layout and description of construction plant, with special reference to conveyor system for transportation of concrete aggregates.

FOUNDATIONS. Unique Devices Developed to Aid Dam Foundation Grouting. *Eng.-News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, p. 191. TVA engineers perfect "feeler" to determine location, depth, and thickness of seams beneath dam site, and "flusher" to wash and clean openings before grouting.

FLOOD CONTROL

LEVEES, FLORIDA. Cheap Levees by Hydraulic Fill at Lake Okeechobee. *Eng. News-Rec.*, vol. 115, no. 3, July 18, 1935, pp. 81–84. Hydraulic dredges, with special-type cutters, used for handling mixture of sand, marl, and blasted rock at strikingly low cost in constructing 66-mile defense against storm-wave inundation.

FLOW OF FLUIDS

SOLIDS, FLUID SUSPENSION. Conveyance of Solid Particles by Fluid Suspension, R. F. Davis. *Engineering*, vol. 140, nos. 3625 and 3629, July 5, 1935, pp. 1–3, and Aug. 2, 124–125. Although there have been established fairly definite velocities at which erosion of material occurs, it is believed that mechanics of process with respect to horizontal flow, and application of consistent mathematical theory has not been described; attempt made to establish general principle embracing conveyance of solid particles in both liquids and gases.

FOUNDATIONS

COFFERDAMS, CONSTRUCTION. Cellular Cofferdam Incloses 18-Acre Area for Building Steamship Piers 1,100 Ft Long. *Construction Methods*, vol. 16, no. 9, Sept. 1934, pp. 32–37. Construction of cellular cofferdam, consisting of 43 earth-filled, 50-ft pockets with walls of interlocking steel sheet-piles 46 to 96 ft long, for New York City's three new 1,100-ft piers.

SOILS, ICE PRESSURE. Ice-Pressure Determinations in Clay Soils, A. Casagrande. *Eng. News-Rec.*, vol. 115, no. 4, July 25, 1935, p. 127. Investigation of pressures exerted by growing ice lenses in freezing clay; crystallization pressure increases approximately in direct proportion to amount temperature is below freezing. From paper before Soc. Promotion Eng. Education.

HYDROLOGY, METEOROLOGY, AND SEISMOGRAPHY

RAIN AND RAINFALL, INTENSITY. Frequency of Intense Rainfall in Iowa Analyzed. *Eng. News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, pp. 190–191. Curves of frequency of intense monthly and 24-hr rainfall in Iowa, taken from records of stations in seven cities up to Jan. 1, 1934.

RIVERS, SALT WATER INTRUSION. Final Report to Sanitary Water Board by Bureau of Engineering on Salinity Survey of Delaware River. Report and Appendix A. Appendix B containing blueprints under separate cover. Harrisburg, Pa., Commonwealth of Pa., Dept. of Health. Mimeographed copy. May 1935, 75 pp. and supp., tables, diagrs., charts. Results of field study of effect of impounding of waters of upper Delaware and diversion to New York City; also of releases from proposed impounding reservoirs upon tidal Delaware River and upon public and private water supplies derived therefrom.

SOILS, EROSION. Menace of Soil Erosion, J. H. Stallings. *Am. Water Works Assn.—J.*, vol. 27, no. 4, Apr. 1935, pp. 513–519. Statistical data on land erosion in North Carolina; effect on streams.

INLAND WATERWAYS

CANAL LOCKS, CONSTRUCTION. Three Cableways of 1,510-Ft Span Place 250,000 Yd of Concrete in Montgomery Island Locks. *Construction Methods*, vol. 16, no. 7, July 1934, pp. 26–30. Description of equipment and methods used in concrete placing; general construction plan; cofferdam; excavation; caissons; cableways; mixing plant; concrete; night lighting; floods; progress; administration.

RIVERS, HYDRAULICS. Large Model Aids Study of Bonneville Project, H. W. Young. *Eng. News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, pp. 195–196. Model study of hydraulic features of Columbia River above and below Bonneville Dam; predetermination of river action governed design of important dam features.

LAND RECLAMATION AND DRAINAGE

DRAINAGE, ALBANIA. Engineering for Land Drainage in Balkans, F. W. Knipe. *Agric. Eng.*, vol. 15, no. 7, July 1934, pp. 223–225. Author's land drainage and irrigation experience in Balkan countries, particularly Albania. Before Am. Soc. Agric. Engrs.

EROSION, CHECK DAMS. Recommendations for Control and Reclamation of Gullies, O. C. Ayers. *Iowa State College Agriculture & Mechanic Arts—Eng. Experiment Station—Bulletin 121*, vol. 33, no. 41, Mar. 13, 1935, 71 pp., 3 supp. sheets. Treatment of small gullies; principles governing use of check dams; overfall protection; temporary check dams; semi-permanent or soil saving dams.

MATERIALS TESTING

CONCRETE, POROSITY. Zur Vereinheitlichung der Wasserdurchlaessigkeitsversuche von Beton, R. Kraus. *Bautenschutz*, vol. 5, no. 9, Sept. 5, 1934, pp. 101–107, including discussion. Standardization of permeability test of concrete; description of apparatus used; specifications.

CONCRETE VIBRATING. Device for Vibrating Molds for Concrete Test Specimens, R. W. Bailey. *Eng. News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, pp. 199–200. Method of preparing and testing of concrete samples with special vibrator.

STUCCO, ADHESION. Test Adhesion of Stucco to Concrete Block, J. H. Lucas. *Concrete*, vol. 43, no. 4, Apr. 1935, p. 6. Strength of bond exceeds tensile strength of stucco; details of testing equipment.

PORTS AND MARITIME STRUCTURES

BREAKWATERS. Evolution of Breakwater, W. N. Elgood. *Engineer*, vol. 160, no. 4152, Aug. 9, 1935, pp. 140–141. Only general outline of evolution considered.

BREAKWATERS, FOUNDATIONS. Designing Breakwater Foundations Against Wave Scour. *Eng. News-Rec.*, vol. 115, no. 4, July 12, 1935, pp. 123–124. Details of failure of Algiers rubble-foundation breakwater on north coast of Africa in 1934; reconstruction methods; mattress and concrete block protect light stone fill; graded stone-fill breakwater at Haifa, Palestine.

JETTIES, CONCRETE BLOCK. Concrete Blocks Replace Stone in Jetties Battered by Sea, G. F. Whittemore and H. A. Finch. *Eng. News-Rec.*, vol. 115, no. 6, Aug. 8, 1935, pp. 192–194. Successful substituting of concrete coping and pre-cast blocks for large stone in rehabilitating two large rock-fill jetties at entrance to Humboldt Bay, about 200 miles north of San Francisco; details of pre-cast containers used in casting 50-ton blocks by filling compartments with concrete after containers were placed; cost data.

MARSEILLES. Recent Development Works at Port of Marseilles, B. Cunningham. *Engineering*, vol. 40, no. 3629, Aug. 2, 1935, pp. 107–110, supp. plates. Illustrations of works in hand; additional accommodation being provided in form of large basin known as Mirabeau Basin; within basin there will be great mole or jetty, 930 m in length and 210 m wide; principal arm of basin will afford access to four drydocks, with length of from 250 to 350 m, and petroleum basin.

PIERS, CONSTRUCTION. Chute System Delivers Concrete from Floating Plant to Pier Walls. *Construction Methods*, vol. 16, no. 11, Nov. 1934, pp. 32–35. Floating mixing and hoisting plant with tower-chute distributing system, which mixed and placed 31,000 cu yd of concrete required in construction of pier and slip walls of parts of New York City's three new 1,100-ft piers built within 15-acre area inclosed by cofferdam between West 47th and West 52d streets, along the North River.

SEAWALLS, GREAT BRITAIN. Sunderland Corporation Quay, W. H. S. Tripp. *Civ. Eng. (London)*, vol. 29, no. 342, Dec. 1934, pp. 412–419, 1 supp. sheet. Construction of reinforced-concrete seawalls with cargo-handling equipment; total cost £320,000.

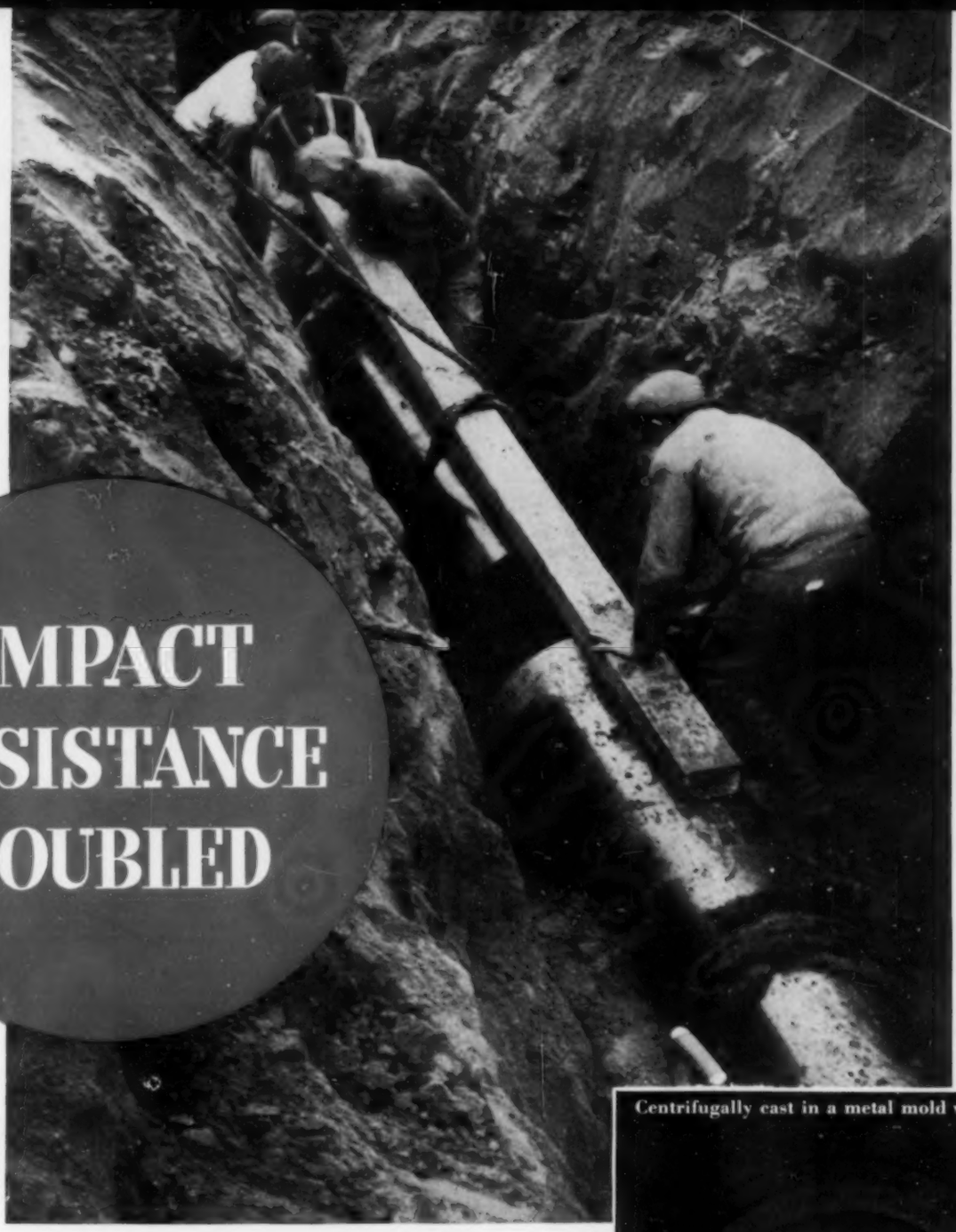
ROADS AND STREETS

BAKED EARTH. Heat Treatment of Soils as Base for Road Construction. *Commonwealth Engr.*, vol. 21, no. 12, July 2, 1934, pp. 399–400. Progress in application of patented Irvine process of construction of baked earth roads by erecting stationary type of heating plant to which soils are hauled and treated, and then to respread product on to road in similar fashion as with metal or gravel, or by reverberatory type of furnace moving slowly along road surface, thus heat-treating soil in situ.

BITUMINOUS, MANUFACTURE. Prepared Tars and Their Application to Road Construction, J. Edwards. *Roads and Road Construction*, vol. 13, no. 147, Mar. 1935, pp. 81–82. Notes on manufacture of refined tars; application of refined tar; macadam tars; grouting; horizontal vs. vertical tars; tar-bitumen mixtures.

BITUMINOUS, NEW YORK. New York State's Experience with Low-Cost Bituminous Pavements, D. Noonan. *Roads & Road Construction*, vol. 13, no. 145, Jan. 1, 1935, pp. 20–23. Specifications for hot and cold penetration bituminous macadam; results obtained with pre-mixed seal coat; surface treatment.

BRICK, PAVING. Twenty-ninth Annual Meeting of National Paving Brick Association—*Proceedings*, Feb. 6, 7, and 8, 1935, 95 pp. Proceedings of 1935 meeting as follows: Developments in Bituminous Mastic for Bed Course, P. E. Sundstrom; Chestnut Street, Philadelphia, and Williamstown Road, North Adams, Mass., W. C. Perkins; Brick Curb Construction—Scioto County, Ohio, G. F. McKinney; Report of Research Bureau, W. C. Rueckel; Highway Bridges, J. R. Burkey; Resurfacing Municipal Pavements with Brick, M. P. O'Brien; Reclaimed Brick Pavements, F. A. Daum; Brick Pavement Construction, R. E. O'Connor; Symposium on Manufacture of Paving Brick by De-Airing; Effect of Degree of Vacuum and Other Forming Problems, T. B. McAvoy, Jr.; Drying Problems, W. Barrett; Effect of De-Airing on Firing, E. V. Poston; Effect of Equal Temperature Distribution and Cooling Problems, G. R. Robinson; Properties of De-Aired Paving Brick, R. B. Keplinger; Plans for Study of De-Aired Paving Brick, F. H. Jackson.



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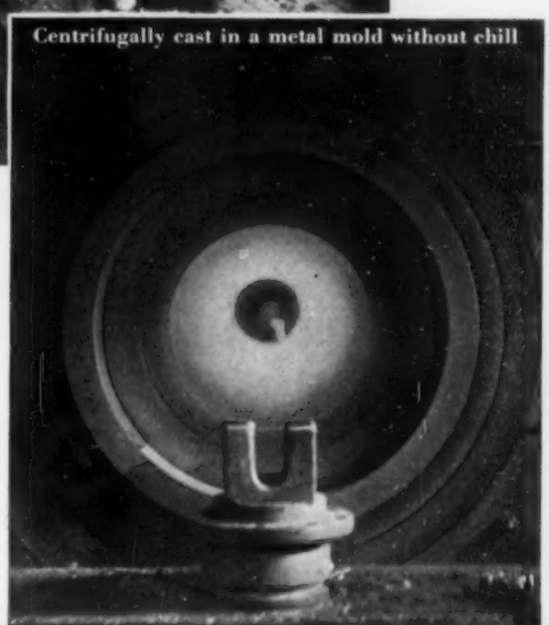
A 270-year-old main in France still transports water—a 500-year-old temple roof in China still sheds rain — both are cast iron. The passing centuries which have proved cast iron's effective resistance to rust have also witnessed great advances in the manufacture of cast iron pipe. The Super-de Lavaud Process, developed and patented by this Company, is the first commercially practicable method of producing *unchilled* gray iron castings in a metal mold. Super-de Lavaud Pipe with doubled impact strength, *cast without chill in a metal mold*, was publicly announced in February 1934. In December 1935, with nearly 9 million feet installed, evidence is overwhelming to the effect that Super-de Lavaud is a stronger, tougher, more ductile pipe. Ask for descriptive literature.

Centrifugally cast in a metal mold without chill



U.S. SUPER-de LAVAUD PIPE

CAST WITHOUT CHILL IN A METAL MOLD

UNITED STATES PIPE AND FOUNDRY CO., General Office: BURLINGTON, N. J.

Foundries and Sales Offices throughout the United States

CIVIL ENGINEER; M. Am. Soc. C.E.; 48; married; 20 years experience in design, location, and construction of highways, bridges, wharves, airports, drainage systems; 10 years in responsible charge of $13,000,000 construction program. Desires connection with industrial or utility corporation where business training and technical knowledge are essential. D-4312.

SANITARY ENGINEER; Assoc. M. Am. Soc. C.E.; graduate civil engineer; 13 years experience in the design and construction of sewage treatment plants and sewers—in the past 2 years has specialized in chemical type sewage treatment plants. Available on reasonable notice. C-874.

MANAGING ENGINEER; M. Am. Soc. C.E.; registered in Pennsylvania. Extensive record in supervision of engineering, estimating, and structural plant operations. Direction of general sales and very successful record as district representative of steel and construction materials. C-5095.

JUNIOR

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single; B.S., C.E., University of Illinois; 6 months experience drafting and detailing reinforced concrete structures; 5 months railroad surveying; 1½ months hydraulic experimental work; 1 year general field work; 7 months executive position in connection with government construction program. Desires connection with private firm or municipality. Free to travel. D-3595.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Clarkson College of Technology, 1931; M.S., Massachusetts Institute of Technology, 1933. Specialized in water power engineering and hydraulic models. Now temporarily employed by the U. S. Coast and Geodetic Survey. Desires position in the field of hydraulics. Location immaterial. D-3148.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 25; single; no experience; B.S. in C.E., University of California, 1935. Desires position in any branch of civil engineering. Salary immaterial. Available immediately. Location anywhere, but prefers Pacific Coast. D-4461-355-A-9 San Francisco.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; married; B.S. and M.S. in C.E., University of Colorado; graduate work in hydraulics and structures; 6 months experience as instructor; 6 months as instrumentman, U. S. Coast and Geodetic Survey; 1 year with the U. S. Bureau of Public Roads. Desires opportunity in any branch of civil engineering; prefers design or construction. Location immaterial. Available immediately. D-4282.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 30; married; B.S. in C.E. degree, 1932; 3 months surveying; 9 months concrete roads; 3 summers bridge and building (railroads); 1 year installation of frigidaire equipment, including air conditioning. Desires opportunity in any branch of engineering. D-4462.

MISCELLANEOUS

DRAFTSMAN, SURVEYOR; Jun. Am. Soc. C.E.; 29; married; 3 years Rensselaer Polytechnic Institute; 1 year New York University. Experience: 3 years structural steel detailing on bridges and other railroad structures; 15 months surveying and construction work in field; 6 months plant layout, equipment, heating; 15 months estimating, computing. References. Available. D-4295.

ENGINEER, RESEARCH WORK; Jun. Am. Soc. C.E.; 30; married; B.S. M.A., Colorado State College; 5 years experience with the U. S. Bureau of Reclamation in designing, construction, and testing of hydraulic models; computation, compilation of data, and preparation of reports. Responsible charge of laboratory; desirous of connection with chance for advancement. D-4426.

SALES

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; 15 years sales engineering experience; acquainted with public works officials and contractors throughout East; will consider representing manufacturers of meritorious public works products; has own office. B-5401.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1935. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ANALYTICAL AND APPLIED MECHANICS. By Guy R. Clements and Levi T. Wilson. New York and London, The McGraw-Hill Book Company, Inc., 1935. 420 pp., tables, diagrs., charts, 9 x 6 in., cloth, $3.75.

This book is a simple but rigorous discussion of the mathematical and physical theory necessary for a thorough first course in mathematics. It presents a wide variety of applications of direct usefulness to the student of engineering. When a topic admits of both graphical and analytical solution, both methods have been discussed.

A.S.T.M. STANDARDS ON PRESERVATIVE COATINGS FOR STRUCTURAL MATERIALS (Paints, Varnishes, Lacquers, and Paint Materials), prepared by Committee D-1 on Preservative Coatings for Structural Materials. September 1935. Philadelphia, Pa., American Society for Testing Materials, 1935. 387 pp., diagrs., charts, tables, 9 × 6 in., paper, $1.75 ($1.50 to A.S.T.M. members).

This is a compilation of 103 specifications and methods of tests pertaining to paints, varnishes, lacquers, and paint materials that are at present approved by the American Society for Testing Materials.

DAS AUSBEULEN DES AUF DRUCK BEANSPRUCHTEN FREISTEHENDEN WINKELS. (Mitteilungen aus dem Institut für Baustatik an der Eidg. Technischen Hochschule in Zürich.) Nr. 4. By C. F. Kollbrunner. Zürich and Leipzig, Gebr. Leemann & Co., 1935. 217 pp., illus., diagrs., charts, tables, 9 × 6 in., paper, 7 frs.

The structural problem considered here is the behavior of compressed angles in cases where one flange is free. A formula for buckling under these conditions was developed and tested by several hundred experiments with steel and light-alloy angles. Close agreement was found. The development of the formula and the methods of testing are described in detail.

COMPREHENSIVE TREATISE ON ENGINEERING GEOLOGY. By C. S. Fox. New York, D. Van Nostrand Company, 1935. 392 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $7.50.

This work is intended to take the place of a smaller book, *Civil Engineering Geology*, which Dr. Fox published in 1923. The first section discusses building materials and includes descriptions of the principal rock types, their modes of occurrence and physical characteristics, and the choice of mineral materials for building. The second section considers earth tremors, the stability of earth slopes, quarrying, tunneling, retaining and protecting walls, and building sites. The final selection treats of water supply, including rainfall, geographic questions, river capture and tides, surface and underground supplies, and the quality of water.

EINFÜHRUNG IN DIE TECHNISCHE STRÖMUNGSLEHRE. Bd. 1. Theoretische Grundlagen. By B. Eck. Berlin, Julius Springer, 1935. 134 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 7.80 rm.; paper, 6.60 rm. (25 per cent reduction in the United States.)

In this volume Dr. Eck gives a concise, yet comprehensive exposition of the theoretical principles of hydrodynamics and aerodynamics, for students of physics and engineering. The work is illustrated by many graphs and photographs, the latter being noteworthy illustrations of flow under various conditions.

MATERIALS TESTING THEORY AND PRACTICE, 2 ed. By I. H. Cowdrey and R. G. Adams. New York, John Wiley & Sons, 1935. 144 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $1.75.

This book is intended to provide those taking a laboratory course in the study of materials under stress with a discussion of the methods commonly used for testing and of the fundamental principles involved. Basic methods of attack and interpretation are indicated. The new edition has been brought up to date, and a chapter on the testing of concrete added.

METALLIC ARC WELDING. By H. Harris. New York, Longmans, Green & Co.; London, Edward Arnold & Co., 1935. 199 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $6.

An excellent, readable survey of arc welding. The process and its equipment are described, methods of testing welds are reviewed, and the influence of oxygen and nitrogen are discussed. Chapters are devoted to the aging of weld metal and the welding of steels of various types and of copper and nickel and their alloys. Finally, the principal applications of arc welding are considered.

METHODS OF MEASUREMENT OF DIELECTRIC CHARACTERISTICS AT COMMERCIAL FREQUENCIES. By J. B. McCurley. Dissertation submitted to the Advisory Board of the School of Engineering of the Johns Hopkins University in conformity with the requirements for the Degree of Doctor of Engineering, Baltimore. Authorized reprint from the Proceedings of the American Society for Testing Materials, Philadelphia, Pa., Vol. 35, Pt. 2, 1935. 17 pp., diagrs., charts, tables, 9 × 6 in., paper, 17 cents.

This dissertation consists of two papers, describing investigations of two bridges. The first is a modification of the Doyle and Salter transformer bridge, which offers a rapid, reasonably accurate method for determining dielectric characteristics. The second is a modified Schering bridge. The methods of operation are discussed, the mathematical treatment is outlined, and some experimental results are reported.

PUBLIC LAND SURVEYS. By Lowell O. Stewart. Ames (Iowa), Collegiate Press, Inc., 1935. 202 pp., illus., tables, charts, 9 × 6 in., cloth, $2.25.

This history of public land surveys includes material on origin, legislation, surveys, the contract system, life of the surveyors, evolution of the instructions and field techniques, and quotations from the original instructions. In his development of the technical aspects of public land surveys, the author has considered the instructions under which various surveys were made. This is highly important since a resurvey and relocation must follow the technique of the original survey. Although the author gives his subject wide application, he is concerned primarily with land surveys in Iowa.

SPECIFICATION DOCUMENTS FOR BUILDING MATERIALS AND CONSTRUCTION, 1 ed. By David H. Merrill and Theodore C. Combs. Los Angeles, Pacific Coast Building Officials Conference (124 West Fourth Street), 1935. 528 pp., illus., tables, diagrs., 6 × 9 in., cloth, $5. (Available on order from publishers.)

This volume contains the appended documents of the Uniform Building Code as of July 1, 1935, available for the first time under one cover—checked, collated, and arranged in usable form for ready reference. All documents referred to within the appended documents are also included in this volume, giving a complete set of specifications for building materials and types of construction used in cities and counties operating under any building code referring to national standard specifications.

STRENGTH OF MATERIALS, 2 ed. By E. R. Maurer and M. O. Withey. New York, John Wiley & Sons, 1935. 382 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

The principal change in this revision is in the chapter on columns, which now conforms to the recommendations of the American Society of Civil Engineers. An article on welded joints has been added, and the articles on axial impact and tubes under external pressure have been modified, as have various tables. This edition contains new problems.

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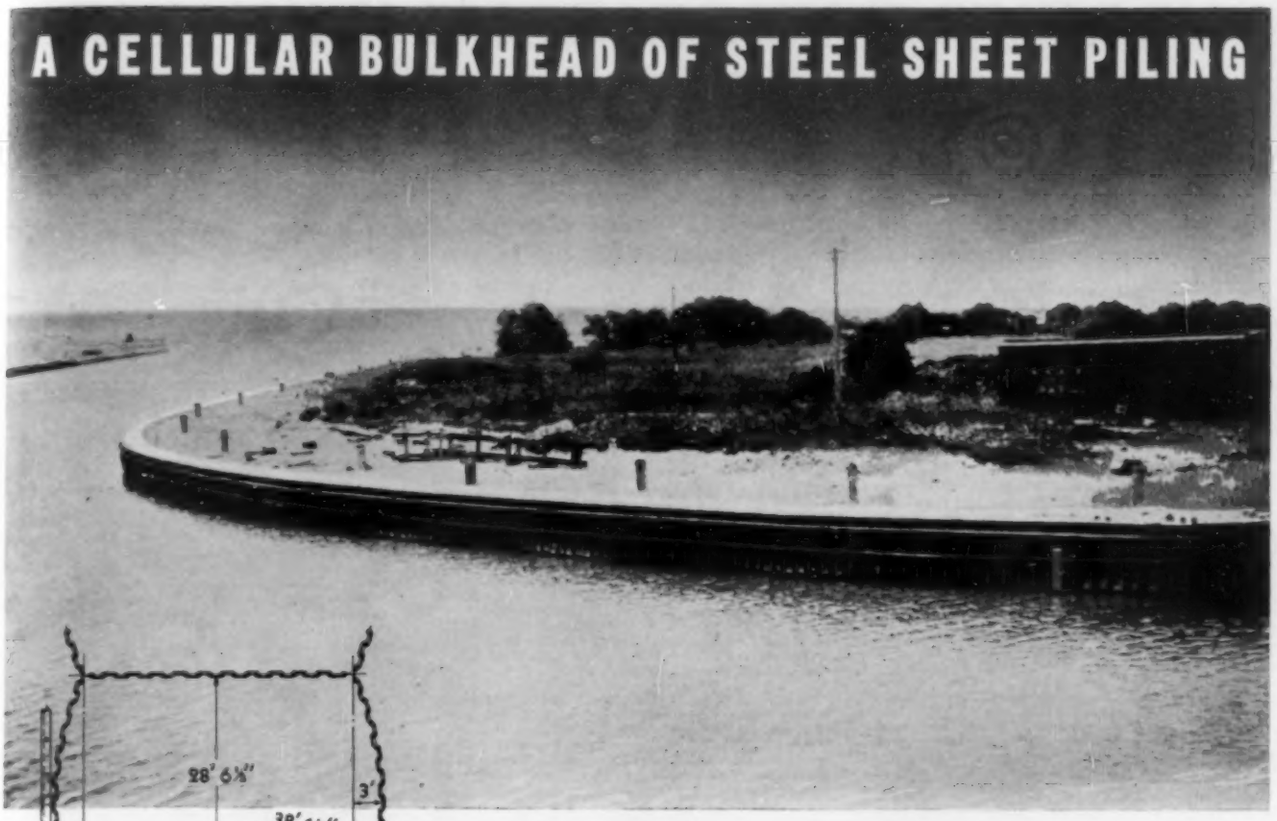
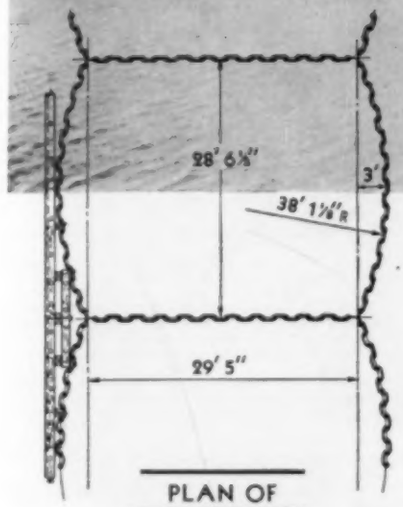
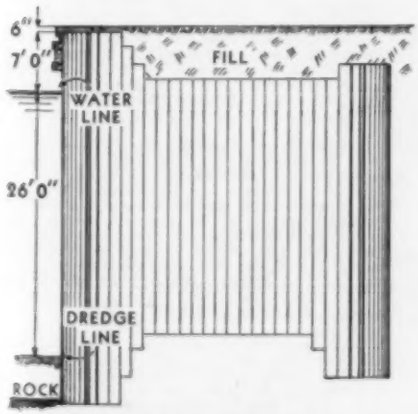
A CELLULAR BULKHEAD OF STEEL SHEET PILING





PLAN OF TYPICAL CELL



SECTION THRU CELL

This cellular type bulkhead economically solved a problem at Huron, Ohio, where anchorage for the ordinary single-wall type of sheet pile bulkhead would have been difficult and where rock bottom was without sufficient overburden to support the toe of the piling. In the cellular design, the cells are self-sustaining structures, eliminating the problem of anchorage. The steel sheet piling is all in tension so that beam strength is not a factor, nor is penetration at the toe necessary. The use of our lightest straight-web section, M-112, was thus made possible.

A wide range of efficient sections, both straight and arch-web, and long experience in the practical application of steel sheet piling make us confident we can serve you to advantage, regardless of how difficult your individual problem may be.

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CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

CONCRETE ARCH, CANADA. Large Concrete Arch Bridge Across Credit River, A. Sedgwick. *Eng. & Contract Rec.*, vol. 48, no. 48, Nov. 28, 1934, pp. 1005–1012. Design and construction of new highway bridge between Toronto and Hamilton, consisting of four arch spans from 70 to 155 ft in length, totaling 841 ft; deck and guard rail design; alternative designs; construction methods; arch centering; concreting operations.

CONCRETE ARCH, STRESSES. Photo-elastic Determination of Temperature Stresses in Arch Bridge Model, Z. Levinton. *Eng. J.*, vol. 17, no. 12, Dec. 1934, pp. 513–517. Photo-elastic method of determining stress by polarized light; series of tests on bakelite model of arch of Broadway bridge at Saskatoon, made to ascertain stresses in arch ribs and columns due to change of temperature. Bibliography.

FLOORS. Inspection of Aluminum Bridge Floor. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, p. 215. Abstract of report revealing excellent condition of aluminum floor framing and decking on Smithfield Street Bridge over Monongahela River in Pittsburgh.

HIGHWAY, APPROACHES. Bridge Approaches. *Eng. & Contract Rec.*, vol. 48, no. 29, July 18, 1934, pp. 634–635. Construction of 1,550 ft of concrete viaduct and 1,740 ft of earth embankment for approaches of Honore Mercier Bridge over St. Lawrence River near Montreal; from five to six spans poured each week.

RAILROAD STRUCTURES, MASONRY. Report of Committee VIII—Masonry. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 374, Feb. 1935, pp. 839–875. Specifications and principles of design of plain and reinforced concrete; progress in concrete manufacture; foundations; methods of lining and relining tunnels; pneumatically projected concrete or mortar; design of expansion joints involving masonry structures; study of specifications for overhead highway bridges.

STEEL ARCH, FEDERATED MALAY STATES. Iskandar Bridge, Perak, Federated Malay States, F. G. Coales and C. H. Clarkson. *Instn. Civ. Engrs.—Min. Proc.*, vol. 240, pt. 2, no. 4900, 1935, 26 pp., 1 supp. sheet. Design and construction of 7-span, steel-arch highway bridge 928 ft long, maximum span 150 ft; roadway 33 ft wide.

STEEL TRESTLE, MOVING. Moving Rock Creek Bridge Eighty Feet in Eight Hours. *Constructor*, vol. 16, no. 7, July 1934 pp. 12–13 Method of moving 750-ft steel trestle bridge, weighing 1,226 tons, to new position 80 ft down valley of Rock Creek, in Washington, D.C.

STEEL TRUSS, NEW ORLEANS. Great Bridge at New Orleans Nearing Completion. *Ry. Age*, vol. 99, no. 11, Sept. 14, 1935, pp. 326–331. Main bridge, 3,524 ft 10 in. long, consists of three 267-ft deck-truss spans; one 330-ft deck-truss span; one 528-ft simple through-truss span; and three-span through-truss cantilever structure made up of 790-ft central span and two 528-ft flanking spans. Silicon steel used in railway floor system, designed to accommodate both railroad and highway traffic.

STEEL, WELDING. Largest All-Welded Bridge Completed in New Jersey, A. F. Davis. *Am. Welding Soc.—J.*, vol. 14, no. 8, Aug. 1935, pp. 2–4. Description of largest truss bridge ever built in United States by welding, just completed across the Rancocas River, connecting Riverside and Delanco, N.J.; built at cost of $270,890; bridge is 387 ft long, with roadway 36 ft wide between curbs and one sidewalk 5 ft in width from center line of bridge truss to center line of handrail; width of bridge, measured from center to center of trusses, is 38 ft 6 in.

SUSPENSION, CONSTRUCTION. Suspension Bridge Towers Erected with Guy Derrick. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, pp. 218–222. Use of 75-ton guy derrick, supported on light steel staging on center line of bridge, in erecting structural steel towers 270 ft high and 98 ft wide for 1,380-ft span of Triborough suspension bridge at New York.

VIADUCTS, STEEL. Strengthening Taradale Viaduct. *Commonwealth Engr.*, vol. 21, no. 10, May 1, 1934, pp. 303–306. Strengthening of 2-track, 4-span trestle viaduct having total length of 662 ft, by constructing of intermediate steel-frame towers at mid-spans, on Melbourne-Bendigo railway, Australia.

WOODEN, STANDARDIZATION. Report of Committee VII—Wooden Bridges and Trestles. *Am. Ry. Eng. Assn.—Bul.*, vol. 36, no. 374, Feb. 1935, pp. 781–837, 14 supp. sheets. Revision of manual; simplification of grading rules and classification of timber for railway uses; overhead wooden or combination wooden and metal highway bridges; wooden trestles for heavy loadings; improved design of timber structures to give longer life with lower maintenance cost.

BUILDINGS

EARTHQUAKE EFFECTS. Einwirkung von Erdbeben auf Bauwerke, R. Briske. *VDI Zeit*, vol. 79, no. 12, Mar. 23, 1935, pp. 389–390. Observation on effect of earthquakes on buildings in light of recent experience in Bulgaria, Japan, and other countries.

HEAT INSULATION. Insulation Methods for Old Buildings, G. D. Mallory. *Eng. & Contract. Rec.*, vol. 48, no. 51, Dec. 19, 1934, pp. 1053–1057. Control of heat losses through walls; inside and outside methods; exterior renovations; additions; basements; heating equipment; when to insulate old house; cost.

HOSPITALS, AIR CONDITIONING. Insulation and Ventilation of Hospital Operating Rooms to Reduce Summer Temperature, R. B. Saxon. *Heating, Piping, & Air Conditioning*, vol. 7, no. 4, Apr. 1935, pp. 219–221. Changes made in operating room at College of Medicine of University of Nebraska; tables presented giving operating-room temperature records.

CITY AND REGIONAL PLANNING

PARIS. L'aménagement de la région parisienne. (Travaux à effectuer par application des lois du 14 mai 1932 et 7 juillet 1934), P. Razous. *Génie Civil*, vol. 106, nos. 8 and 9, Feb. 23, 1935, pp. 173–180, and Mar. 2, pp. 204–207, 3 supp. plates. Changes in plan and improvements in communications, water supply, sewerage, and port facilities of Paris on basis of laws of May 14, 1932, and July 7, 1934; metropolitan subway line extensions; water supply and sewerage system extensions; treatment of city wastes; utilization of idle areas.

STREET TRAFFIC CONTROL. Die Parkfrage in den deutschen Grossstaedten Wege zu ihrer Loesung, G. Mueller. *VDI Zeit*, vol. 79, no. 11, Mar. 16, 1935, pp. 350–352. Review of automobile parking problem in German cities.

CONCRETE

CEMENT, HANDLING. Concrete Producer Installs Bulk-Cement Handling and Batching Units. *Pit & Quarry*, vol. 27, no. 9, Mar. 1935, pp. 35–36. Methods and features of equipment used in handling of cement by Superior Ready-Mixed Concrete Co., at St. Bernard, Ohio.

CONSTRUCTION, UNDERGROUND. Beton unter Tage, R. Gruen. *VDI Zeit*, vol. 79, no. 10, Mar. 9, 1935, pp. 333–334. Review of applications of concrete construction in shafts, tunnels, and other underground structures; methods of protecting concrete against chemical disintegration.

READY-MIXED, PRESENT AND FUTURE. Ready-Mixed Concrete—Its Present and Future, H. F. Thomson. *Concrete*, vol. 43, no. 5, May 1935, pp. 17–18. Abstract of paper before National Ready-Mixed Concrete Assn.

REINFORCEMENT. New Web Reinforcement Simplifies Placing Problems, W. Flesher. *Concrete*, vol. 43, no. 6, June 1935, pp. 7–8. Continuous strip type of web steel urged in place of loose stirrups; design and inspection also much easier.

DAMS

CONCRETE GRAVITY, CONSTRUCTION. Cofferdams in Swift Water for Bonneville Dam, C. I. Grimm. *Eng. News-Rec.*, vol. 115, no. 10, Sept. 5, 1935, pp. 315–318. Method of floating 1,400-ton cribs into line in 7-mile current by cable control for building concrete spillway dam 1,250 ft long and 170 ft high; plan and progress; design and construction; launching and placing; sealing cribs; unwatering; deflection of cribs; contract cost $1,037,000.

CONCRETE GRAVITY, MOROCCO. El Kansera Dam, Morocco. *Engineer*, vol. 160, no. 4156, Sept. 6, 1935, pp. 236–238. Illustrated description of gravity-type dam constructed on Oued Beht, 100 km east of Rabat; power station situated 925 m. downstream of dam; penstock tunnel through which water flows to turbines is 860 m long and 4 m in diameter; height of dam is 43 m and above lowest point of foundations, 63 m.

EARTH, COREWALLS. Unmapped Broded Limestone Complicates Corewall Job, F. Gannett. *Eng. News-Rec.*, vol. 115, no. 10, Sept. 5, 1935, pp. 328–330. Excavation for cut-off wall of Ontelaunee Dam at Reading, Pa., revealed extremely irregular nature of limestone rock surface which could not be predicted from exploratory borings; unusually high quantities of cement taken up by some of grouting holes.

EARTH, FAILURE. Floods Wash Out Dam in Colorado and Change River Channel in Nebraska. *Eng. News-Rec.*, vol. 115, no. 10, Sept. 5, 1935, pp. 341 and 343. First information on washout of Horse Creek flood control earth dike 40 ft high, 2,300 ft long.

EARTH, FLOOD CONTROL. Controlling Flood Waters on Chama River, G. E. Moore. *Excavating Engr.*, vol. 28, no. 12, Dec. 1934, pp. 553–555, 577 and 582. Excavation and earth work for gravel and earth-fill El Vado Dam of Middle Rio Grande Conservancy District, New Mexico.

EARTH, STEEL PLATES. Steel Used Extensively in Building El Vado Dam, C. P. Seger. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, pp. 211–215. Design and construction of gravel-fill dam, located on Chama River near New Mexico-Colorado line, 1,300 ft long and 175 ft high; welded steel plates used to make watertight upstream face and to line spillway channel; steel liner plates employed in forming part of permanent lining of diversion tunnel; cut-off wall had to be carried deep into left bank because of shattered condition of rock.

HYDRAULIC FILL, MONTANA. Fort Peck Dam. *Eng. News-Rec.*, vol. 115, no. 9, Aug. 29, 1935, pp. 279–306, 2 supp. plates. Symposium on design and construction of world's largest hydraulic-fill dam 9,000 ft long, 273 ft maximum height; Fort Peck Project and Dam, T. B. Larkin; Fort Peck Project Structures; Fort Peck Land Buying Based on Aerial Maps; Exploring Foundations and Pits, T. A. Middlebrooks; Stripping Base of Dam; Steel Sheetpile Cut-off Wall; Placing Hydraulic Fill; Enlargement from Center Headings; Excavation Methods and Equipment, Concrete Structures for Spillway; Aggregate and Toe Material Plants.

United States Steel Corporation Subsidiary

ALUMINUM RAILINGS *"walk off"* AT FLOOD TIME

What? — removable bridge railings? Usually bridge engineers want the opposite — immovable fixity. Travelers on the Pan-American Highway southward, preparing for many surprises, are intrigued by the great International Highway Bridge across the Rio Grande between Laredo, Texas and Nuevo Laredo, Mexico, which is *different.*

Record breaking floods have submerged these concrete arches at rare intervals, causing damage to the original fixed railing which impeded flow and passage of driftwood. As consultants to the Laredo Bridge Company, the J. W. Beretta Engineers, Inc., of San Antonio, Texas, met this problem by designing removable railings of Alcoa Aluminum. Easy removal and replacement is effected when floods threaten. One man can handle a ten foot Aluminum section which weighs only 94 pounds and a small force of men can remove the entire 1,900 feet of railing in an hour.

This installation at Laredo is a dramatic example of the application of strong, light alloys of Alcoa Aluminum to bridge construction. Here the weight saving is used to conserve human energy and simplify a flood problem. Usually the purpose of Aluminum is quite different. Weight savings on complete Aluminum floor systems, for example, are great enough to beneficially affect span lengths, tower construction, trusses, cantilevers and suspensions. Alcoa Engineers have many helpful facts and figures. Consultation is invited. ALUMINUM COMPANY OF AMERICA, 1827 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA

ALCOA · ALUMINUM

MOVABLE, ROLLERS. Roller Gates in Navigation Dams, W. H. McAlpine. *Military Engr.*, vol. 26, no. 150, Nov.-Dec. 1934, pp. 419–423. Features of American roller-gate dams recently built on upper Mississippi and Kanawha rivers; flap-type roller; flap regulation with gate on sill.

SPILLWAYS, DESIGN. Safety Feature in Earth Dam Spillway Tested in New York Flood, W. V. R. Freets. *Eng. News-Rec.*, vol. 115, no. 10, Sept. 5, 1935, p. 319. Omitting section of corewall between spillway and shore side of Hornell Dam No. 3 to provide intentional point of weakness that will wash out before dam is overtopped; design predictions confirmed.

FLOOD CONTROL

FLOODS. Floods and Their Economic Importance, G. H. Matthes. *Military Engr.*, vol. 26, no. 148, July-Aug. 1934, pp. 265–268. Compacted sedimentary deposits; channels maintained by high stages; deposits at mouths of tributaries; results of river development; predetermining effect of flood curtailment. Before Am. Geophysical Union.

LEVEES, CONSTRUCTION, BLASTING. Blasting Methods at Lake Okeechobee, M. R. Budd. *Explosives Engr.*, vol. 13, no. 8, Aug. 1935, pp. 231–242 and 253. Report on progress in levee construction in Florida, with special attention to blasting applications and procedure.

LEVEES, CONSTRUCTION, DIRT MOVING. Something New in Dirt Movers on River, C. D. Calkins. *Excavating Engr.*, vol. 28, no. 11, Nov. 1934, pp. 501–504 and 508–509. Methods and equipment used in construction of levee in Laconia Circle Levee District, Mississippi Valley, with special reference to Chambers Bridge consisting of plate-girder structure 372½ ft long, supported by double A-frame tower in center; from top of this A-frame, hoisting cables extend to both ends of bridge; supporting A-frame tower contains power plant and operating controls and is mounted on caterpillar treads to facilitate moving.

LEVEES, FLORIDA. Lake Okeechobee Project, G. Kumpe. *Military Engr.*, vol. 26, no. 149, Sept.-Oct. 1934, pp. 308–372. History of levee construction project, totaling over 55 miles in length and 26,000,000 yd of levee material; levee contracts; construction by government plant; hurricane gates and drainage culverts.

MISSISSIPPI RIVER. Checking Rampages of the Mississippi, R. G. Skerrett. *Compressed Air Mag.*, vol. 40, no. 6, June 1935, pp. 4742–4745. Under present plan of flood control, backwater areas and floodways will be available for expansion in time of flood, and these avenues will proportionately reduce volume of water traveling onward toward Gulf of Mexico between main levees.

NEW YORK, CLOUDBURSTS. Record Stream Discharges Feature New York Floods. *Eng. News-Rec.*, vol. 115, no 3, July 18, 1935, pp. 91–94. Cloudbursts in localized areas precipitated one-quarter of yearly rainfall in two days, and large runoff swelled streams to record stages, causing estimated damage of $25,000,000.

NEW YORK, RAINFALL. Heavy Rainfall and Floodflows in New York Area. *Eng. News-Rec.*, vol. 115, no. 5, Aug. 1, 1935, pp. 161–162. Unusually heavy precipitation, most of which occurred in one 24-hr period, resulted in many record-breaking stream discharges; rainfall records and stream discharges in central New York, July 6–11, 1935.

OHIO. Muskingum Flood Control Forges Ahead. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, pp. 232–234. Progress report on construction of largest reservoir flood-control project of U. S. Army, being built in southeastern Ohio; plan of operation; organization chart of engineering staff; selecting reservoir sites and designing 14 dams necessary.

FOUNDATIONS

BOREHOLES, EXPLORATORY. Piping to Obtain Bed Rock Samples Below Heavy Overburden, J. Belknap. *Can. Min. J.*, vol. 56, no. 4, Apr. 1935, pp. 139–140. Details of procedure to bring up actual samples of rock indicated by magnetometer readings; 3-in. pipe hammered down through over-burden and ½-in. pipe with water pressure used to flush out loose material; hollow-chambered drill bit and drill rods are manipulated by hand; drawback to system is small size of samples obtained; suggested modification, providing for taking small core.

BRIDGE PIERS, CONCRETE. Rigid-Frame Concrete Bridge Has Double Elastic Piers, F. C. Hart. *Construction Methods*, vol. 16, no. 12, Dec. 1934, pp. 32–33. Construction of concrete double elastic piers of Crooked Creek Bridge at Harrison, Ark., consisting of independent sections spaced 1 ft apart at bottom and 1 in. at top.

BRIDGE PIERS, CONSTRUCTION. Sinking Deep Caissons at Normal Pressure, R. G. Skerrett. *Compressed Air Mag.* vol. 40, no. 7, July 1935, pp. 4778–4782. Novel procedure followed in constructing piers for bridging Little Belt in Denmark.

GROUND-WATER CONTROL. Well Points and Concrete Pump Build Foundation of Slum Clearance Housing Project. *Construction Methods*, vol. 16, no. 12, Dec. 1934, pp. 22–25. Groundwater control of foundation for 12-story buildings of Knickerbocker Village in New York City.

PILES, HEAVING. Heaving and Distortion of Piles, A. M. Bouillon. *Military Engr.*, vol. 26, no. 149, Sept.-Oct. 1934, pp. 373–380. Conditions causing heaving and distortion; extent and evidences of heaving; remedial measures; distortion and heaving due to same forces; piles which resist heaving and distortion; holding-down power of piles; piles driven in clay; increasing supporting power of soil.

SOILS, PHYSICS. New Facts in Soil Mechanics from Research Laboratories, A. Casagrande. *Eng. News-Rec.*, vol. 115, no. 10, Sept. 5, 1935, pp. 320–323. Recent research develops new earth-pressure theory and discloses unexpected data on consolidation characteristics of clays and behavior of soils subjected to shearing stresses; new testing apparatus; logarithmic scale graphs; action of sand under shear; practical significance of shear.

TESTING. Ein neues Gernet zur Pruefung des Baugrundes, J. Vacek. *Bautenschutz*, vol. 5, no. 7, July 5, 1934, pp. 82–85. Description of patented K. Fischer apparatus for testing bearing strength of foundations by means of installation comprising pump, hydraulic press, and concrete block.

INLAND WATERWAYS

PANAMA CANAL. Engineer's Recollections—IX. Early Days at Panama, J. F. Stevens. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, pp. 216–217; Sept. 5, 1935, pp. 330–333. Author's recollections; question of sea level vs. lock canal; construction plant and transportation service.

RIVERS, CANADA. Columbia River in Canada, J. C. MacDonald. *Eng. J.*, vol. 17, no. 11, Nov. 1934, pp. 471–477, (discussion) 478. Description of river and its drainage area north of international boundary; facilities for navigation, irrigation problems, questions of dyking and drainage, power development and water storage possibilities on Canadian side of border. Before Eng. Inst. Canada.

RIVERS, EROSION. Scour in River Beds, M. G. Ionides. *Engineer*, vol. 160, no. 4154, Aug. 23, 1935, pp. 196–197. Indication of how problem of bed variation may be attacked by graphical method.

IRRIGATION

SPAIN. Der neue Wasserwirtschaftsplan Spaniens, W. Vieser. *Wasserwirtschaft u Technik*, vol. 2, nos. 18–20 and 21–22, July 5, 1935, pp. 211–215 and July 25, pp. 242–244. Review of irrigation water resources of Spain and outline of 25-year plan for construction of 382 projects for irrigation of 1,207,000 hectares in eastern provinces; cost estimates.

LAND RECLAMATION AND DRAINAGE

CULTIVATION. Landwirtschaftliche Kultivierungen nach Entwaesserung, R. Sandner. *Wasserwirtschaft u Technik*, vol. 2, nos. 18–20, July 5, 1935, pp. 202–206. Methods of bringing land reclaimed by drainage under cultivation; breaking up of soil; cultivating equipment; fertilization; cost estimates.

MATERIALS TESTING

BUILDING MATERIALS, SPECIFICATIONS. Cementitious, Ceramic, Concrete and Masonry Materials. *Am. Soc. Testing Matls.—Proc.*, vol. 34, pt. 1, mtg., June 25–29, 1934, pp. 307–399. Reports of committees on cement, brick, lime, refractories, concrete, and concrete aggregates, hollow masonry building units, gypsum, and concrete pipe.

CONCRETE, VOLUME CHANGES. Volume Changes in Cement, Mortar and Concrete, S. L. Meyers. *Concrete*, vol. 43, no. 8, Aug. 1935, pp. 16–20. Series of tests determines coefficient of expansion due to changes in temperature; apparatus used; effects of moisture; tabular data. Bibliography.

ROAD MATERIALS, ASPHALT. Road Materials. *Am. Soc. Testing Matls.—Proc.*, vol. 34, pt. 1, mtg., June 25–29, 1934, pp. 916–943. Tentative specifications, and methods of testing emulsified asphalts and liquid asphalt products.

PORTS AND MARITIME STRUCTURES

BREAKWATERS, FAILURE. Breakwater Failures, C. Cagli. *Engineer*, vol. 160, no. 4155, Aug. 30, 1935, p. 221. Editorial review of paper before Instn. of Civil Engrs. on Italian harbor works, demonstrating inherent weakness and insufficiency in certain respects of both Algiers and Catania designs.

BREAKWATERS, STEEL. Cellular Steel Breakwater for Calumet Harbor, T. L. Condron. *Eng. News-Rec.*, vol. 115, no. 3, July 18, 1935, pp. 86–91. Construction of breakwater extension at Calumet, Ill.; structural design; failure of isolated cells by Lake Michigan wave action; recalculation of design strength; similar lake structures compared; method of construction; quantities and costs.

BREAKWATERS, WAVE EFFECT. Wave Action on Vertical Wall Breakwaters, B. Cunningham. *Nature (London)*, vol. 136, no. 3434, Aug. 24, 1935, pp. 283–286. Methods of recording wave pressure at port of Genoa, Italy; discussion of failure of breakwaters at Catania and Algiers; lessons to be learned from these failures. Bibliography.

CHANNEL DEEPENING. Improving Miami's Harbor. *Explosives Engr.*, vol. 13, no. 7, July 1935, pp. 208–213. Project of Arundel Corp., using dynamite and modern equipment, to deepen 6-mile channel; details and use of ladder dredge, "Corozal"; blasting methods.

CHURCHILL, CANADA. Churchill, on Hudson Bay, Canada's Newest Seaport, E. L. Chicanot. *Mar. Rev.*, vol. 65, no. 9, Sept. 1935, pp. 16–17 and 40. Port features, characteristics, and future possibilities.

DOCKS, CAPE TOWN, SOUTH AFRICA. Big Dock Extension at Cape Town. *Engineer*, vol. 160, no. 4155, Aug. 30, 1935, p. 218. Particulars of accommodations to new mail steamers being built and other ships of similar size projected; present emergency scheme provides one new deepwater berth, 900 ft long equipped with modern cranes and rail and road facilities; adjacent to it will be erected new precooling plant with capacity of 4,000 tons storage.

MARINE BORERS. Notes on Life of Marine Borers, W. F. Clapp. *Mar. News*, vol. 22, no. 4, Sept. 1935, pp. 24–26. Consideration of life history of three species which are at present undermining marine structures in harbors of North Atlantic.

MISSISSIPPI. Ports of Gulfport and Pascagoula, Miss. *U. S. Army Corps Engrs.—Port Series*, no. 19, 1935, 103 pp., 6 supp. sheets. Price 20 cents. Revision of data originally published as Port Series No. 19; information showing movement of commerce through ports, facilities available for handling traffic, and rates and charges applying against it.

PILES, WOODEN, PRESERVATION. Report of Committee 7-4-1—Marine Piling Service Records. *Am. Wood-Preservers' Assn.—Proc.*, mtg., Jan. 22–24, 1935, pp. 249–260, (discussion) 260–264. Records of marine piling installations that have given outstanding service, and of installations that have failed on account of improper methods of seasoning, treatment, or handling after treatment.

SAINT JOHN, N.B. Greater Saint John, J. H. McLellan. *Nauf. Gaz.*, vol. 125, no. 18, Aug. 31, 1935, pp. 4–6. Port facilities; building activity; reasons which make port desirable as point of manufacture and place of residence.

SAN DIEGO, CALIF. San Diego, Port Traffic Is Steadily Increasing, C. F. Reynolds. *Mar. Rev.*, vol. 65, no. 9, Sept. 1935, pp. 14–15 and 40. Brief historical review; flow of commerce aided; nature of commerce; harbor improvements under way.

WOODEN. Use of Treated Timber in Port Structures in New York Harbor, F. J. O'Keefe. *Am. Wood-Preservers' Assn.—Proc.*, mtg. Jan 22–24, 1935, pp. 164–167, (discussion) 167–169. History of teredo and limnoria in waters washing shores of five boroughs comprising Greater New York, with particular reference to piers, wharves, bulkheads, and other works under author's direct supervision.

ROADS AND STREETS

CONSTRUCTION. Curve Elimination Buffer-shot, W. F. Rappold. *Explosives Engr.*, vol. 13, no. 9, Sept. 1935, pp. 277–279. Large well-drill blast made without traffic interruption on busy highway in Orange County, New York.

EXPANSION JOINTS. Joints for Concrete Highways Demand Use of Engineering Principles, L. J. Mensch. *Concrete*, vol. 53, nos. 1 and 3, Jan. 1935, pp. 11–12, and Mar., pp. 21–22. January: Historical review of joint design since 1885. March: Recent trend in concrete highway joints favors water-tight types developed for reinforced-concrete bridge floors; dowels recommended.

FROST DAMAGE. Sand Cushion Eliminates Frost Heaving on Quebec's Newer Highways, A. Paradis. *Eng. & Contract Rec.*, vol. 48, no. 40, Oct. 3, 1934, pp. 845–850. Results of experiments on frost heaving, during winter of 1933–1934; factors governing use of sand cushion; laying sand cushion; gravel substitute; construction of foundation. Before Can. Good Roads Assn.

● In 19 months' service (February 1, 1933 to September 15, 1934) this 24" hydraulic dredge pump handled approximately 1,400,000 cubic yards of torpedo sand and 4,250,000 cubic yards of clay, sand and silt. In spite of the abrasive character of the materials the amount of wear on its Nickel Cast Iron shell was almost negligible. This pump is a product of the Nordberg Manufacturing Co., Milwaukee, Wisc.

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MAINTENANCE AND REPAIR. How Provincial Highways Are Maintained During Wintertime. *Eng. & Contract Rec.*, vol. 48, no. 44, Oct. 31, 1934, pp. 933–935. Symposium including following papers: Quebec, A. Paradis; British Columbia, A. Dixon; Manitoba, W. Youngman; Saskatchewan, H. S. Carpenter; Alberta; Nova Scotia; New Brunswick.

SEWERAGE AND SEWAGE DISPOSAL

ACTIVATED SLUDGE. Bio-chemical Changes in Formation of Activated Sludge, H. Heukelekian. *Sewage Works J.*, vol. 7, no. 2, Mar. 1935, pp. 214–221. Simultaneous changes taking place in liquor and sludge produced from sewage during continuous aeration; effect of aeration after sludge has been produced; changes in solids content; B.O.D. changes in production of activated sludge by continuous aeration of sewage; effect of aeration on nitrate and dissolved oxygen content and pH value of sewage; purifying power of activated sludge.

ACTIVATED SLUDGE, FILTERS. Experiments on Settling and Filtering Activated Sludge Aerated Liquors. North Side Treatment Works, Sanitary District of Chicago, S. I. Zack. *Sewage Works J.*, vol. 7, no. 3, May 1935, pp. 514–533. Experimental study of Laughlin magnetite filter and tank tests on settling-filter activated sludge liquors; operating features of North Side plant as affecting aerated liquor handled by Laughlin tank; solids handled and sludge concentration in Laughlin tank; head loss through filter.

ACTIVATED SLUDGE, VARIATION. Effect of Varying Daily Charge of Sewage Solids on Activated Sludge Process, H. Heukelekian. *Sewage Works J.*, vol. 7, no. 3, May 1935, pp. 405–416. Results of laboratory study to determine if efficiency of process and character of sludge were affected by relationship between relative amounts of raw solids and activated sludge solids, and if variations of this relationship affect efficiency and character of sludge. Bibliography.

AERATION. Purification of Sewage by Aeration, H. Heukelekian. *Sewage Works J.*, vol. 7, no. 3, May 1935, pp. 393–404. Experimental study for determination of effect of aeration on degree of purification of sewage; with different sewages aeration period of 6 hr, followed by sedimentation, resulted in greater degree of purification than could be obtained by plain sedimentation; greater reduction of B.O.D. was also obtained. Bibliography.

ANALYSIS, STANDARDS. Standard Methods of Sewage Analysis, W. D. Hatfield. *Sewage Works J.*, vol. 7, no. 3, May 1935, pp. 444–491. Report of Committee on Methods of Sewage Analysis of Federation of Sewage Works Assns.; examination of sewage, effluents, industrial wastes, and grossly polluted waters; examination of sewage sludge and muds. Bibliography.

CHLORINATION. Chlorination Methods in Connection with Sewage Treatment. *Eng. & Contract Rec.*, vol. 48, no. 42, Oct. 17, 1934, pp. 889–892. Disinfection of raw sewage and sewage effluents; reduction of bio-chemical-oxygen demand; application of chlorine, method and amount; quantity of chlorine necessary; varying of chlorine dosage; tests for chlorine demand and residual chlorine. Abstract of report of Committee on Sewage Disposal of Pub. Health Eng. Section of Am. Pub. Health Assn.

ODOR CONTROL. Measurement of Intensity and Concentration of Odors Associated with Sewage Treatment Processes, G. M. Fair and E. W. Moore. *Sewage Works J.*, vol. 7, no. 2, Mar. 1935, pp. 182–199. Measurement of odor intensities; design of osmoscope or odor observer; some observed odor intensities. Bibliography.

PIPE, VITRIFIED CLAY. Experience in De-Airing Sewer Pipe, M. W. Blair. *Brick & Clay Rec.*, vol. 86, no. 4, Apr. 1935, p. 138. Manufacture of de-aired sewer pipe, which has proved satisfactory from every standpoint; de-airing equipment on sewer-pipe pug-mill and press described and illustrated.

PLANTS, VALUATION. Rating of Sewage Treatment Works. Report of Rating Committee, New York State Sewage Works Association. *Sewage Works J.*, vol. 7, no. 2, Mar. 1935, pp. 233–250. Plan for rating of works according to adequacy of operating data and records; condensed summary of rating schedules; outline form of reports to be submitted to Rating Committee and credits to be assigned in calculation of final ratings.

PROBLEMS. Sewage Treatment Problems and Trends, C. G. Hyde. *Sewage Works J.*, vol. 7, no. 2, Mar. 1935, pp. 222–232. Changing character of municipal sewage; increasing use of mechanical appliances; increasing use of screenings disintegrators or comminutors; screenings incineration; pretreatment of sewage to remove oil, grease, and scum; development of chemical treatment; sludge handling and disposal; odor destruction; salvage of sewage for irrigation and industrial use. Before N.Y. State Sewage Works Assn.

RESEARCH. Research in Sewage Chemistry, Sewage Treatment and Stream Pollution, W. Donaldson, L. H. Enslow, L. M. Fisher, S. A. Greeley, W. S. Mahlie, W. Rudolfs, and E. B. Phelps. *Sewage Works J.*, vol. 7, no. 2, Mar. 1935, pp. 149–181. Critical review of American and European literature of 1934 in sewage chemistry and biology. Bibliography.

SEDIMENTATION. Notes on Sedimentation, L. V. Carpenter and H. W. Speiden. *Sewage Works J.*, vol. 7, no. 2, Mar. 1935, pp. 200–209, (discussion) 210–213. Review of technical literature; mathematical considerations; use of models; effects of temperature; flowing-through period; sedimentation formula. Bibliography. Before Pa. Sewage Works Assn.

SEWAGE TANKS. Super-Settler System of Sedimentation. *Engineering*, vol. 140, no. 3634, Sept. 6, 1935, pp. 259–260. Tank introduced by International Filter Co., Chicago, designed to secure much greater efficiency for equal volume, as compared with usual tank.

SLUDGE. Horizontal Filter of New Type Dewaters Sewage Sludge at East York Disposal Works. *Eng. & Contract Rec.*, vol. 48, no. 46, Nov. 14, 1934, pp. 967–969. Description of caLOco horizontal filter consisting of stationary vacuum boxes over which is carried endless suction mat, by which vacuum is carried through filter medium to sludge; sludge is carried down length of machine on filter cloth traveling at same speed as suction mat; at dry end of machine, filter cloth leaves suction mat, discharging cake, and returns to top of mat at feed end.

STREAM POLLUTION, OXIDATION. Measures of Natural Oxidation in Polluted Streams. I—Oxygen Demand Factor, H. W. Streeter. *Sewage Works J.*, vol. 7, nos. 2 and 3, Mar. 1935, pp. 251–279; and May 1935, pp. 534–552. Basic principles underlying natural oxidation phenomena; laboratory measurement of bio-chemical oxidation; bio-chemical oxidation under natural conditions; effect of inflow; effects of sedimentation and adsorption; effect of "immediate" oxygen demand; effect of 2-stage B.O.D.; Nature and laws of atmospheric reaeration; resultant oxygen curve; application of formulas. Bibliography.

UNITED STATES. Sewage-Treatment Facilities in United States. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, p. 224, 1 supp. sheet. Tabulated data of inventory of sewage disposal in United States by states.

STRUCTURAL ENGINEERING

BEAMS, STEEL. Beam-Strengthening Effect of End Connections, K. G. Merriam. *Eng. News-Rec.*, vol. 115, no. 10, Sept. 5, 1935, pp. 333–335. Laboratory investigation of beam-to-column connections demonstrating appreciable stress reductions by taking into account continuity or restraints at beam ends; data and results for structural angle connection and for split H-beam connection.

CONCRETE SLABS, STRESSES. Distribution of Concentrated Loads in Reinforced Concrete Slabs, C. V. Rundell. *Engineer*, vol. 160, no. 4153, Aug. 16, 1935, pp. 161–162. Reasonings governing author's theory, being based upon root principles, may be effectively applied to all structures, as theory takes into account all variables of slab thickness, steel and concrete working stresses, size of rods employed, and all other features embodied in design of structure.

MODELS. Use of Engineering Models, A. V. Karpov. *Military Engr.*, vol. 26, no. 150, Nov.-Dec. 1934, pp. 435–440. Critical review of methods of testing engineering structures by means of models; mathematical, physical and photo-elastic models; surface models for solving stress problems; similarity conditions for models of dams; Calderwood arch dam and Boulder Dam models.

TILE, FLOOR. Greater Market Possibilities Promised by Reinforced Clay Tile Floor, H. Giese and C. T. Bridgman. *Brick & Clay Rec.*, vol. 86, no. 6, June 1935, pp. 201–202. Consists of pre-cast beams and floor tile; cost said to be only slightly over frame; tests reveal strength and stiffness of floor.

TUNNELS

VEHICULAR, FRANCE-ITALY. Projet de tunnel routier franco-italien, sous le massif du Mont-Blanc, J. Thomas. *Génie Civil*, vol. 106, no. 14, Apr. 6, 1935, pp. 340–342. Features of proposed vehicular tunnel, 12 km long, under Mont-Blanc to connect highway systems of France and Italy.

WATER PIPE LINES

CAST IRON. Maintenance and Protection of Cast Iron Water Pipes, F. W. F. Waitt. *Instn. Engrs. Australia—J.*, vol. 6, no. 9, Sept. 1934, pp. 293–302. Economic problems met with in design and operation of system of water supply reticulation; new method of graphical comparison of economic alternatives; its use for cast-iron water mains; practical conclusions drawn therefrom for Sydney water supply.

WATER RESOURCES

DROUGHT EFFECT. Ground Water Relieves Drought Emergency, G. H. Taylor and R. M. Leggette. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 359–361. Development of new underground sources of water supply in arid basin in which Salt Lake City is located; artesian flow in deep alluvial fill of Jordan Valley in Utah areas; annual recharge of ground-water supply; threatened shortage relieved by wells; effect of new wells.

WATER TREATMENT

CHLORINATION. Chicago Method of Making Chlorine Residual Determinations, T. F. Donahue, Jr., and E. Zimbon, Sr. *Water Works & Sewerage*, vol. 82, no. 6, June 1935, pp. 228–229. Outline of modification of orthotolidine test made by Chicago water works; new standards required.

PAPER AND PULP MILLS, WHITE WATER. Tolerances in White Water Losses, C. M. Baker. *Paper Trade J.*, vol. 101, no. 13, Sept. 26, 1935, pp. 95–98. Suggested standards; limiting factors. Before Tech. Assn. Pulp and Paper Industry.

PLANTS, SETTLING BASINS. Water-Plant Capacity Increased by Modifying Settling Unit, R. F. Goudey. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 370–371. Experience of Bureau of Water Works and Supply, Los Angeles; flow turbulence and floc breakage in clarification tank of Wilmington filtration plant reduced by revamped inlet design and lengthened effluent weir.

PURIFICATION. Modern Aspects of Water Purification, E. S. Chase. *New England Water Works Assn.—J.*, vol. 48, no. 4, Dec. 1934, pp. 451–459. Sources of supply; selection of purification methods; partial or preparatory treatment; pre-filtration; filters; taste and odor removal; control of corrosion; water softening; iron and manganese removal. Before Instn. Water Engrs.

WATER WORKS ENGINEERING

ANKARA, TURKEY. Modern Water Supply for Turkey's New Capital City, F. A. Liefrinck. *Eng. News-Rec.*, vol. 115, no. 7, Aug. 15, 1935, pp. 225–227. Description of new water works system deriving its supply from underground sources, with special reference to underground concrete dam; features of new storage dam and reservoir for increased supply from surface sources.

CHICAGO. Filters and Meters for Chicago Move Toward Reality, A. E. Gorman. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 371–374. Authorized to issue bonds and build structures on lakefront, city is expected to consummate much-needed filtration and metering program; improvements in South District scheduled for first attention; features of proposed plans and profits.

DENVER, COLO. Denver Goes to West Slope for Additional Water Supply. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 357–358. Diversion of flow of Fraser River and tributaries, on Pacific Ocean watershed, eastward through enlarged pioneer bore of Moffat Tunnel under Continental Divide, then down South Boulder Creek and by diversion canal into tributary of South Platte; financing.

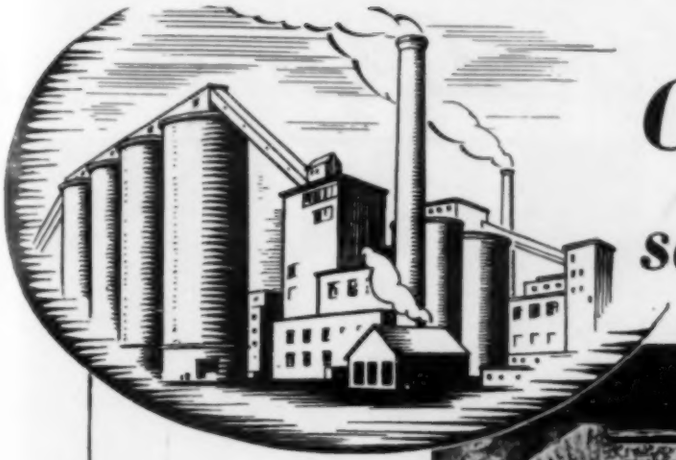
DRILLING. Well Boring, F. L. Matthews. Manchester. *Assn. Engrs.—Trans.*, 1934–1935, pp. 211–227, (discussion) 227–239. Historical review of boring and sinking for water; development of modern boring methods; rotary methods; location of sizes; value of boreholes; author's supplementary remarks.

EAU CLAIRE, WIS. Locating Ground Water Free from Iron and Manganese, A. R. Garnock and P. Hansen. *Water Works & Sewerage*, vol. 82, no. 6, June 1935, pp. 199–204. Methods employed in developing 10-mgd water supply for Eau Claire, Wis.; geological considerations; selection of most favorable well locations; extended pumping test; construction problems.

HARTFORD, CONN. Third Enlargement in 83 Years Under Way in Hartford, C. M. Saville. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 351–356. Extensions to water works, including curved earth dam, 155 ft high; model tests of spillway with capacity of 17,000 cu ft per sec.

MAINTENANCE AND REPAIR. Cold Weather Troubles. *New England Water Works Assn.—J.*, vol. 48, no. 3, Sept. 1934, pp. 320–331, (discussion) 332–344. Symposium on cold weather experience in winter of 1934 in New England municipalities by P. R. Sanders, G. H. Finneran, W. F. Sullivan, and F. H. Kingsbury.

MANAGEMENT. Improved Management Aids Water Works Development, P. C. Gale. *Eng. News-Rec.*, vol. 115, no. 11, Sept. 12, 1935, pp. 365–367. Threatened sale of Michigan City, Ind., municipal plant brings new state law, which permits of appointment of water-works management separate from city; result is reduction in city debt, improved credit, modern accounting, and new pumps, filters, and elevated tank.



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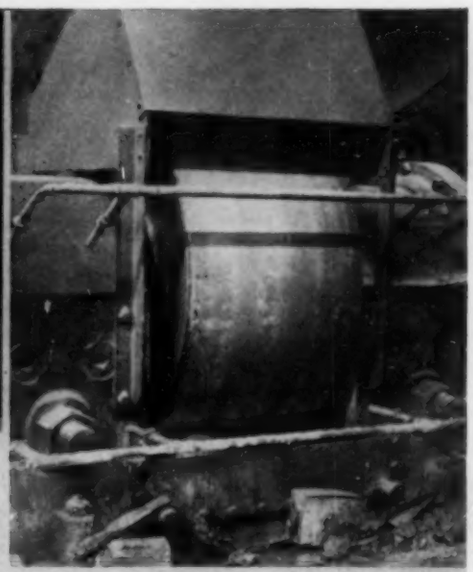

Left — Trunnion bearing block after bronze-welding had been partially completed.

Right — General view of trunnion bearing blocks which support the huge cement kiln.

OXWELDING KEEPS KILN BLOCKS OFF SCRAP PILE

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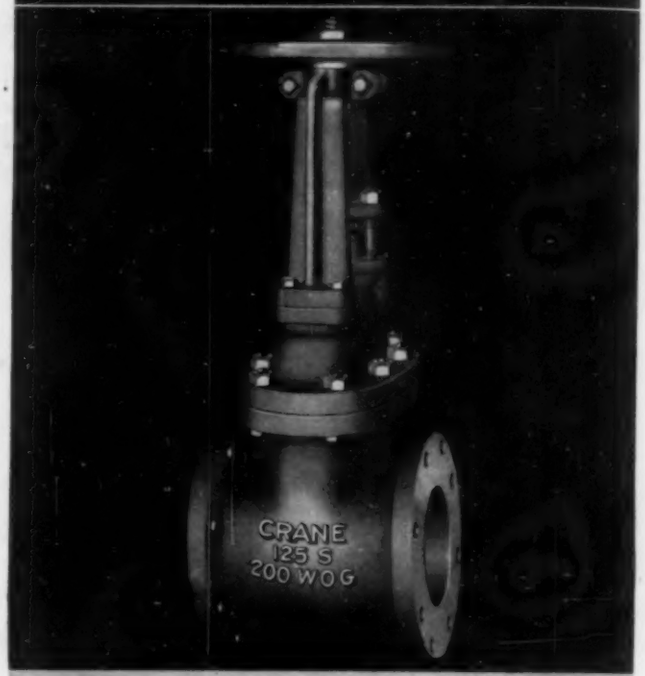

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3 Brass to brass seating surfaces are of a high grade material containing at least 85% copper.

4 Well designed and carefully machined stem threads wear well and operate easily.

5 The Crane line of Standard Iron Body Gate Valves is complete in types, sizes, end connections, and trimming metals.

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CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS • NEW YORK: 23 W. 44TH ST.
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CRANE VALVES, FITTINGS AND PIPE FABRICATION

The Old Mill -
Mountain Brook

NEAR BIRMINGHAM, ALABAMA

Preserving the atmosphere of the past and forecasting the great power developments of the South

CHICAGO'S 3652 *miles of water mains are* 100% CAST IRON---

SAN FRANCISCO
CHICAGO
NEW YORK
Chicago's Water Distribution Mains placed end-to-end would extend from the Pacific to the Atlantic and back to Chicago

Chicago cast iron water main in good condition after more than 80 years of continuous service

MORE than one-and-a-half million lengths of pipe—*100% cast iron*—distribute water to Chicago's three-and-a-quarter million population. In airline distance these cast iron mains placed end-to-end would reach from San Francisco to New York and back to Chicago. The rated pumping capacity of Chicago's system is 1,900,000,000 gallons. The maximum amount of water pumped on one day was 1,280,000,000 gallons.

The average percentage of cast iron pipe in the water distribution systems of the 15 largest cities in the United States is 95.6%.

Cast iron is the standard material for water mains. Cast iron pipe costs less per service year and least to maintain. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust.

For further information address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

"Shield-Arc" WELDING CUT COST OF THIS JOB

Photo courtesy of Southern Steel Works Company, Birmingham, Ala.

DESIGNED for riveting, yet *"Shield-Arc"* welding cut the cost of shop and field fabrication of this auditorium framework. Handicapped by a design costly to welding, *"Shield-Arc"* proved its greater economy.

Learn the advantages of this modern structural fabricating process. It simplifies layout and connection details. Eliminates practically all punching. Reduces handling in the shop. Is quiet in the field. Yet it produces a stronger, stiffer structure with less tonnage than any other method of steel fabrication.

But if you would reap all of the profits of progress you must use the *"Shield-Arc"* welder. It is the only welder that can fulfill its guarantee three ways to produce more welding per dollar. Find out now what this guarantee means to you. Ask THE LINCOLN ELECTRIC COMPANY, DEPT. H-195, CLEVELAND, OHIO. Largest Manufacturers of Arc Welding Equipment in the World.

POP "I've designed a good many structures but this arc-welded job had me stuck until Lincoln showed us how."

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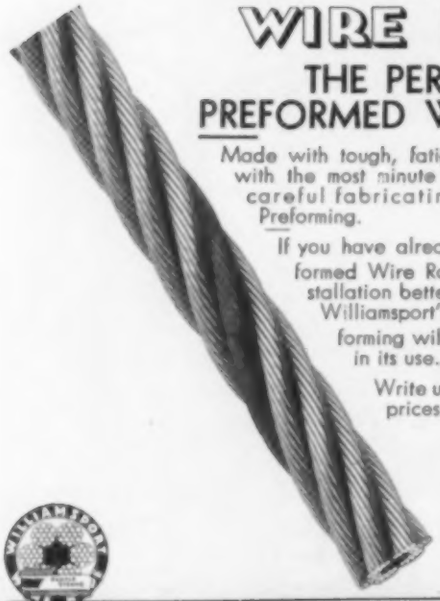
"WILLIAMSPORT *Form-Set*" WIRE ROPE

THE PERFECT PREFORMED WIRE ROPE



Made with tough, fatigue resisting wire, with the most minute accuracy, the most careful fabricating plus precision Preforming.

If you have already found that Preformed Wire Rope serves your installation better, then "Form-Set," Williamsport's method of Preforming will make you happier in its use.

Write us for particulars and prices.

WILLIAMSPORT WIRE ROPE CO.

Main Office and Works, Williamsport, Penna.
Branch Sales Office, 122 So. Michigan Ave., Chicago

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STEEL BRIDGES AND BUILDINGS
TANKS, BARGES, PIPE
TRANSMISSION TOWERS
STEEL PLATE WORK

McClintic-Marshall Corporation

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Crane Co.

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INLAND Sheet Piling Used on WORLD'S LARGEST Cofferdam

Highest Ever Built

The west-side cofferdam at Grand Coulee, one of the three which will be needed in the construction of this great project. This cofferdam was completed in three months. It is almost one-half mile in length, 800 feet wide and 115 feet high. To attain this height, 35 and 40-foot piling was interlocked into a lower wall of 75 and 80-foot piling. Driving distance ranged from 40 to 70 feet to bed rock, requiring at times 400 blows per foot of penetration. The cofferdam will hold back the highest head of water of any structure ever built for a similar purpose. The project is being built by the Bureau of Reclamation of the U. S. Department of Interior. Contractors, Mason-Walsh-Atkinson-Kier Company.

APPROXIMATELY 19,000 tons, more sheet piling than has ever before been involved in a cofferdam for a construction project, is being used for the Grand Coulee Dam on the Columbia River. And, it is all Inland Steel Sheet Piling.

A New Section Shipped in a Week

The contract called for shipments to begin in 7 days, to be completed in 100 days. And also for long length material which would withstand very hard driving.

Despite the fact that the section specified, I-31-S, had not been previously rolled by Inland, the piling met every requirement to the perfect satisfaction of the contractors and the Government engineers.

This splendid example of Inland Service and Inland quality surely warrants your use of Inland material on your next Sheet Piling project. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Illinois.

Sheets Strip Tin Plate
Plates Structurals Piling

INLAND STEEL

Rails Track Accessories
Bars Rivets Billets

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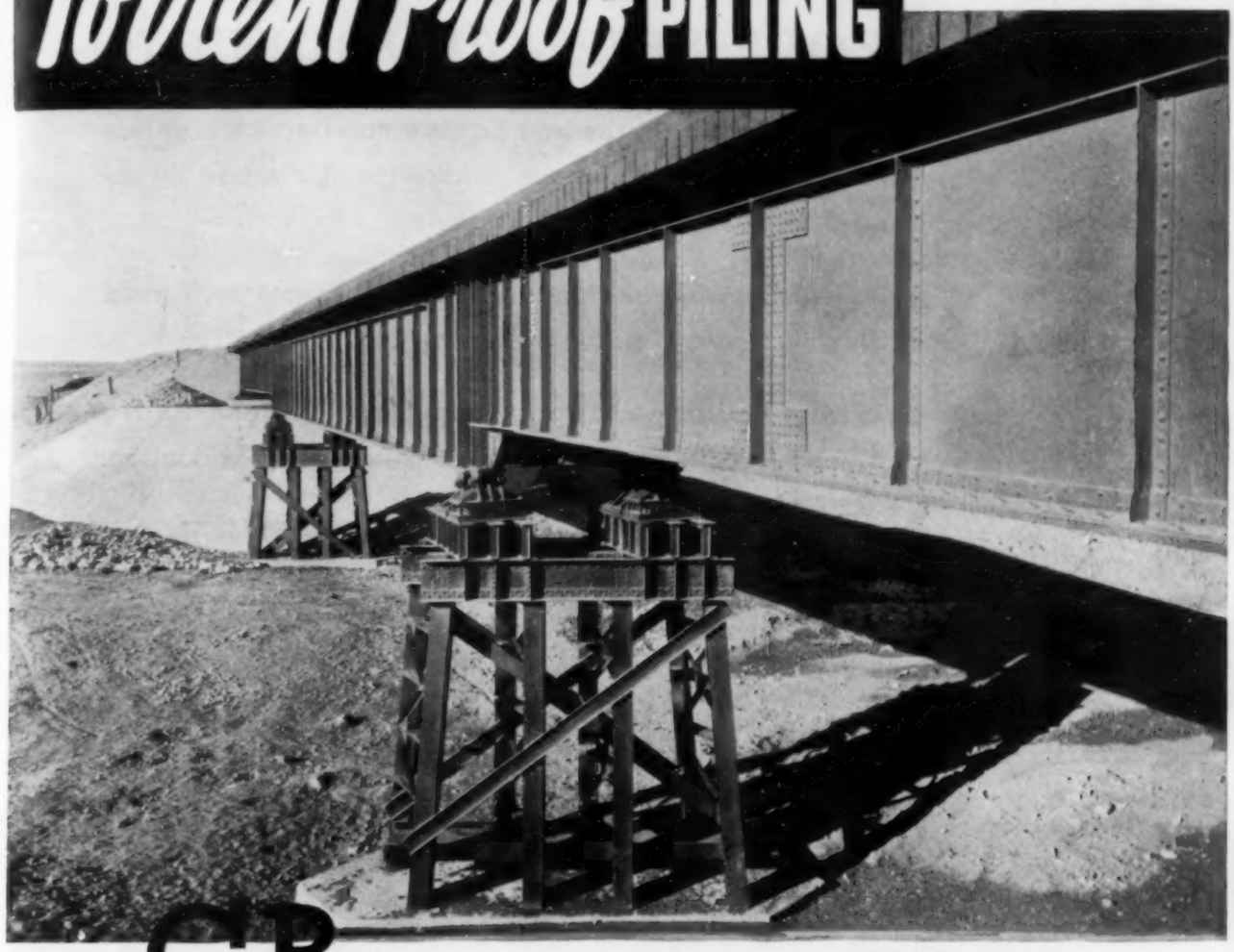
Torrent Proof PILING



Piers constructed of steel bearing piles . . . CB SECTIONS . . . under a new bridge of the Missouri Pacific Railroad Company near Selkirk, Kansas.

CB SECTIONS

Here's a typical instance of the multiple advantages of steel bearing piles

1. High load bearing capacity was needed. The piers shown carry a 100-foot girder span and two 70-foot girder spans.

2. Hard driving conditions existed. Yet no difficulties were encountered in driving the steel piles through clean water-bearing sand and gravel alternating with layers of hard clay.

3. During certain months this normally dry creek bed carries raging torrents. Dependable protection for from 15 to 20 feet against scour was needed . . . and was provided by the steel piles. Concrete protection was provided at and immediately below the stream bed to provide additional stiffness.

Steel bearing piles are rapidly gaining recognition among bridge engineers for their economy and applicability to a wide range of conditions. Additional information supplied upon request.

CARNEGIE-ILLINOIS STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA • CHICAGO, ILLINOIS

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Your MAIN Roads Deserve

Armco Paved Invert Pipe

——and you'll find it costs less per year under other roads, too

GOOD drainage is such a small but important part of your road investment that it certainly pays to use the best. Pavements last longer and maintenance is kept at a minimum, when your roads are drained with Armco Paved Invert Pipe.

This modern, flexible drainage structure is amply strong to resist the heaviest loads and vibration of traffic. It does not break or pull apart. Moreover, Armco Paved Invert Pipe has all the durability your roads require—and more! Its base metal—Armco INGOT IRON—already has a 29-year service record. In addition, the pipe is protected in the bottom, *where the wear comes,* with an "extra life" bituminous pavement. Here is efficient drainage at the lowest cost per year.

Consider this fact the next time you need culverts and drains. And remember, only Armco can offer you a complete "Balanced Drainage" Plan—with a correctly designed product for each size and type of installation. Use this plan for true economy.

ARMCO CULVERT MANUFACTURERS ASSOCIATION
Middletown, Ohio

ARMCO'S "BALANCED DRAINAGE" PLAN

FOR MAIN ROADS
(State Highways and Important County Routes)

Type of Installation	Product Recommended for Best Results
1 Small and medium size openings. (8 to 84 in.)	
a. Entrance Drains	Armco Corrugated Pipe
b. Cross Drains	Armco Paved Invert Pipe
2 Bridges and Large Culverts	Armco MULTI PLATE (Full-round or arches)
3 Subdrains	
a. Paralleling Road	Armco Perfocated Pipe
b. Under Pavement	Armco Perforated Pipe (with Paved Invert)

FOR SECONDARY ROADS
(County and Township Roads)

Type of Installation	Product Recommended for Best Results
1 Small and medium size openings	
a. Normal Conditions	Armco Corrugated Pipe
b. For Steep Grades	Armco Paved Invert Pipe
c. Continuous Flow	Armco Paved Invert Pipe
d. Under High Fills	Armco Paved Invert Pipe
e. Diameters larger than 24 inches	Armco Paved Invert Pipe
2 Bridges and Large Drains	Armco MULTI PLATE (Full-round or arches)
3 Subdrains	Armco Perforated Pipe

Armco Paved Invert Pipe being used in connection with widening a heavily traveled highway, U. S. 127.

ARMCO

★ **FOR TRUE ECONOMY** ★

make service conditions your guide

Open Caissons 250′ to rock

the world's deepest building foundation supports the 50-story Terminal Tower. These record depth caissons and the additional foundations supporting the Cleveland Union Terminal over the tracks are typical of the work of this organization.

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PRETEST UNDERPINNING
PATENTED
SPENCER, WHITE & PRENTIS
NEW YORK DETROIT

FABRICATED **STEEL** STRUCTURES
BRIDGES—BUILDINGS
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Standard Cut-Back Asphalt, Socony Brand, road mix construction in Albany County, New York

STANDARD BRAND
SOCONY
ASPHALTS
AND
ROAD OILS

Standard Asphalt Road Oils
Standard Asphalt Joint Fillers
Standard Waterproofing Asphalt
Standard Cut-Back Surfacing Asphalt
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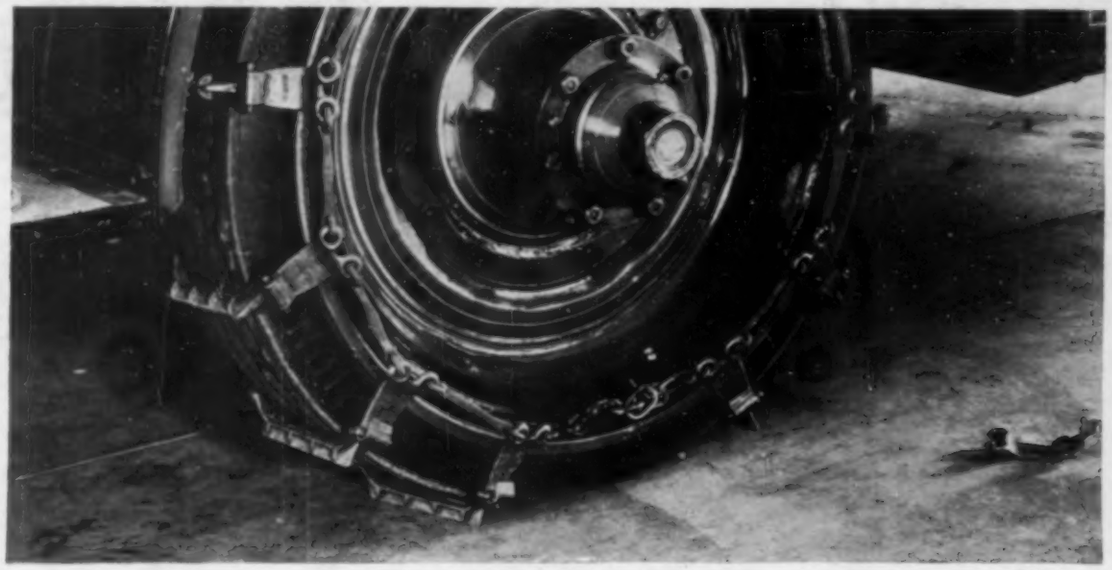
Standard Refined Asphalt for sheet asphalt paving
Standard Cold Patch Asphalt for all types of patching
Standard Asphalt Binders B & C for penetration work (Asphalt Macadam)
Standard Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete)
Standard Asphalt Emulsion for Surface Treatment, Penetration, Road and Plant Mix, and Patching

Specifications and all other particulars furnished on request.

SOCONY-VACUUM OIL CO.
INCORPORATED
STANDARD OIL OF NEW YORK DIVISION



Let 'Em Bite!

'INCOR' CAN TAKE IT

TRAFFIC moves fast at Eastern Massachusetts Street Railway Company's motor-coach garage, Lynn, Mass. Ten-ton buses start and stop suddenly, back up, swing quickly into parking stalls. Bad enough in Summer, the punishment these floors take in Winter is plenty. Sparks fly when chisel-sharp tire-chain links grind on the 'Incor' concrete floor. But let 'em bite—'Incor' can take it!

'Incor' was used to obtain strong, dense, watertight concrete and complete the garage before cold weather set in. Two weeks were saved—freezing risk eliminated and garage in use that much sooner. Reason: 'Incor' combines with water 5 times as fast as ordinary cement. Result, service strengths in 24 hours, watertight curing in 48 hours instead of 10 days. Thorough curing in fraction of usual time is soundest assurance of obtaining stronger, more durable concrete—the kind that stands the gaff.

Write for illustrated book "Heavy Duty Floors." Tells how busy floors are resurfaced over a week-end. Also a timely book on "Winter Construction." Address 'Incor'* Cement, Room 2204, 342 Madison Ave., New York. Made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York; also sold by other leading cement manufacturers.

*Reg. U. S. Pat. Off.

'INCOR' 24-Hour Cement